X-6414

SUPPLEMENT

to

MAINTENANCE MANUAL

X-6114

COACH MODEL

PD-4106

GMC TRUCK & COACH DIVISION
GENERAL MOTORS CORPORATION
Pontiac, Michigan

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Introduction

Information contained in this supplement, when used in conjunction with Maintenance Manual X-6114, provides all the procedures and data required to adequately service the latest Coach Model PD-4106. Since all the equipment covered in this supplement was not introduced in production usage simultaneously, it will be necessary to inspect the units being serviced on each individual coach to determine whether coverage is made in this supplement or in the previous manual.

The information in this supplement is arranged in the same sequence and under the same section headings as in Manual X-6114. This information covers the units and systems in which there have been major changes since Maintenance Manual X-6114 was published.

Refer to the applicable section in this supplement first, to determine whether there is supplementary information before servicing any unit or system on these coaches. If there is none, then service unit or system in accordance with Maintenance Manual X-6114.

SECTION INDEX

Heating and Ventilation

The information contained in Maintenance Manual X-6114 (pages 22 thru 48) is applicable to current production coaches except as otherwise indicated in following paragraphs which cover description and maintenance of latest equipment.

BLOWER MOTOR AND FAN UNITS

The single motor and fan assembly formerly used has been replaced by two motor and fan assemblies, one of which is installed at right and left hand sides of the heating and ventilation compartment. A separate magnetic switch is used for each blower motor. Air circulation is same as on earlier coaches except that air is pulled from the heating compartment through blower inlet rings and is discharged into air ducts after passing through the two blower wheels. Figure 1 shows the heating and ventilating system air flow. The circulation of water is same as earlier vehicles and same controls are used to control blower motors.

A blower wheel is mounted on armature shaft of each motor. Each blower wheel is held to respective shaft by two set screws (fig. 4).

BLOWER AND FAN UNIT PERFORMANCE CHECK

For blower motor speed and current draw, refer to "Specifications" given at end of this section.

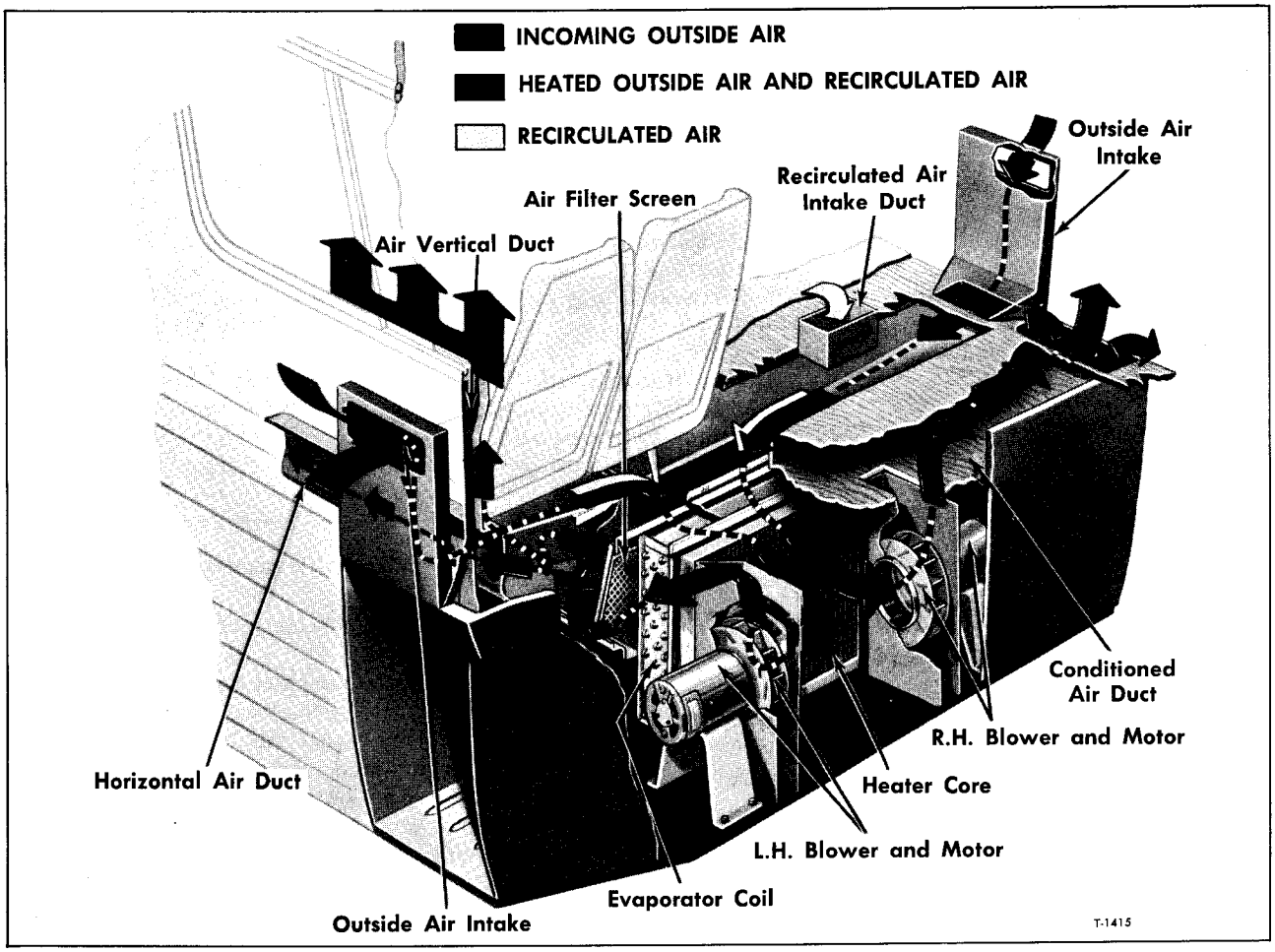
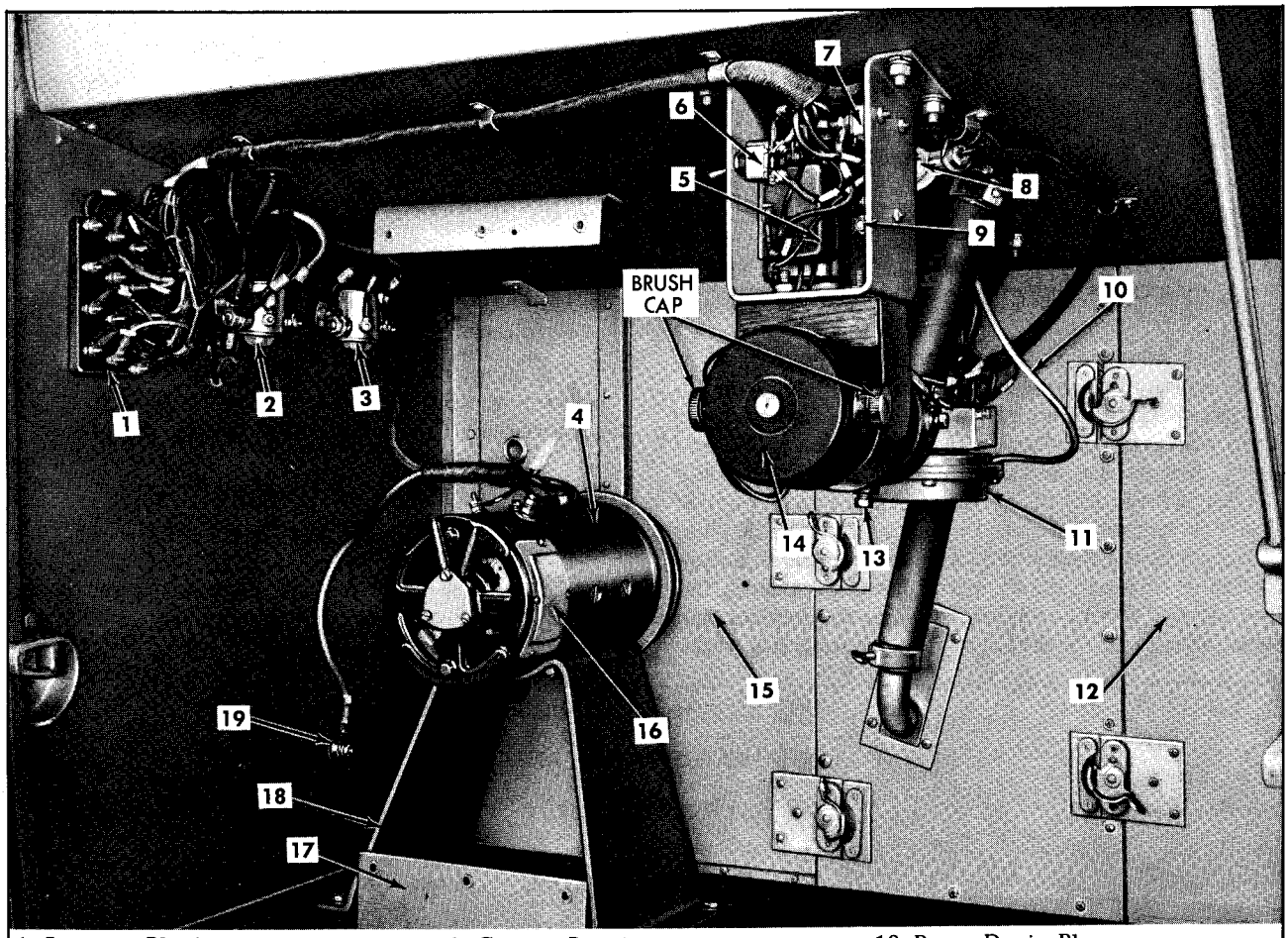


Figure 1—Heating System Air Flow



1 Junction Block
2 R.H. Blower Motor Magnetic Switch
3 L.H. Blower Motor Magnetic Switch
4 Blower Motor
5 Water Pump Relay
6 Compartment Lamp Switch
7 Circuit Breaker
8 Compartment Lamp
9 Rectifier
10 Valve Air Line (From Grad-U-Stat)
11 Water Modulation Valve Assy.
12 Evaporator and Air Filter Compartment Door
13 Pump Drain Plug
14 Booster Pump and Motor
15 Blower Compartment Closure Panel
16 Brush Cover Plate
17 Motor Shield Bracket
18 Motor Support
19 Ground Terminal T-1455

Figure 2—Heating and Air Conditioning Compartment with Blower Motor Shield Removed

BLOWER MOTOR AND FAN UNIT REPLACEMENT

Although the two blower motors are identical, the procedures necessary to replace the right- and left-hand units differ and are given separately.

REPLACING RIGHT-HAND BLOWER MOTOR AND FAN UNIT

1. Open the heating and air conditioning compartment door located behind coach right front wheel.

2. Remove shield from motor shield brackets in compartment.

3. Disengage latches and remove front closure panel (15, fig. 2). Remove attaching screws and remove rear closure panel retainers. Also remove the screws which hold rear closure panel to compartment wall. The rear closure panel cannot be removed until motor mounting bolts are removed.

4. Disconnect wiring from motor terminals.

5. Remove bolts holding motor (fig. 3) mounting bracket to compartment floor, then remove the motor assembly with the mounting bracket and blower wheel as an assembly. Rear closure panel can now be removed.

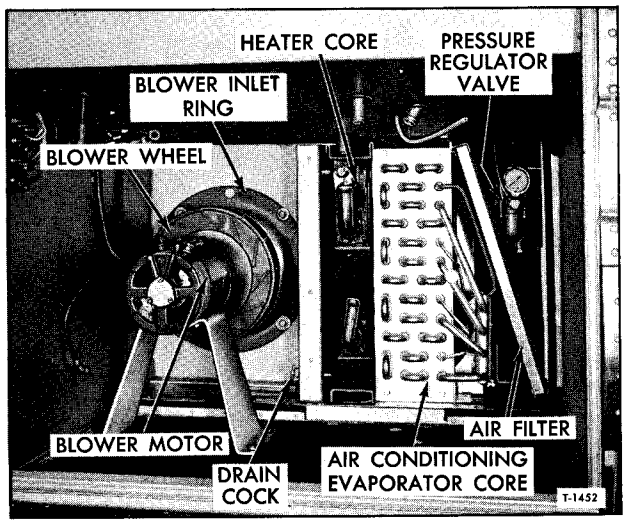


Figure 3—Heating and Air Conditioning Compartment with Inner Panels and Booster Heater Pump Removed

6. To remove the blower wheel from motor, loosen the two set screws (fig. 4) and slide the blower wheel off shaft.

NOTE: Procedure for disassembling blower motor is given later under "Blower Motor Repair."

7. To install blower wheel coat motor shaft with Lubriplate, back out set screws sufficiently to prevent interference as wheel is installed, then position the blower wheel on motor shaft with the two set screws aligned with the flat areas on motor shaft. Tighten set screws with fingers so ends just contact shaft lightly. Final tightening of set screws is done after blower motor has been mounted in compartment and blower wheel is properly located to provide the 1/8 to 3/8 inch overlap with the inlet ring (fig. 5).

8. Set the blower motor and wheel assembly in place with mounting bolt holes aligned with holes in floor. Insert bolts through bracket to hold motor in place, then move blower wheel inward or outward as necessary so edge of wheel will overlap ring as shown in figure 5. When wheel is properly located, a socket wrench may be inserted through wheel blades to tighten set screws sufficiently to hold wheel in place. Remove motor and wheel assembly and tighten set screws securely.

9. Place the blower compartment rear closure panel in corner of compartment and again move blower assembly into position. Install mounting bolts with nuts, flat washers, and lock washers below compartment floor. Tighten nuts firmly.

10. Check for clearance between O.D. of air inlet ring and I.D. of blower wheel. A clearance of 5/64 to 7/64 inch should exist at all points around circumference of inlet ring (fig. 5). If it is necessary to adjust clearance between ring and wheel, loosen the four bolts which secure the ring to the compartment panel and shift the ring as necessary to provide proper clearance. Plugs in rear closure panel may be removed so socket wrench may be used to reach two rear bolts.

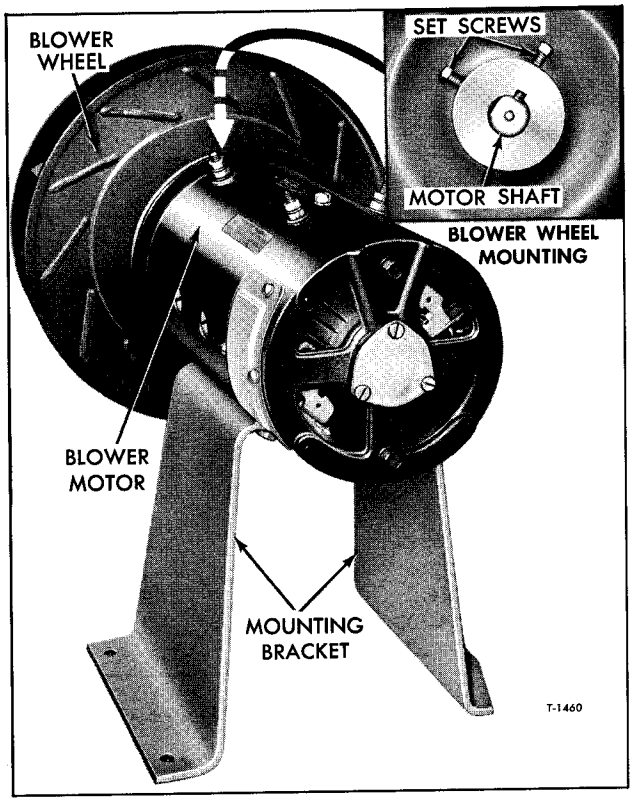


Figure 4—Blower Motor with Blower Wheel and Mounting Bracket Installed

11. Connect electrical wiring to terminals on motor, and check motor operation.

12. Install front closure panel (fig. 2) and secure with latches.

13. Install motor shield at brackets in compartment.

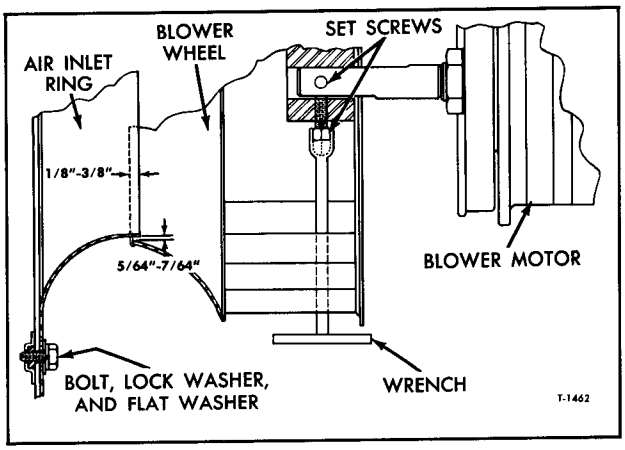
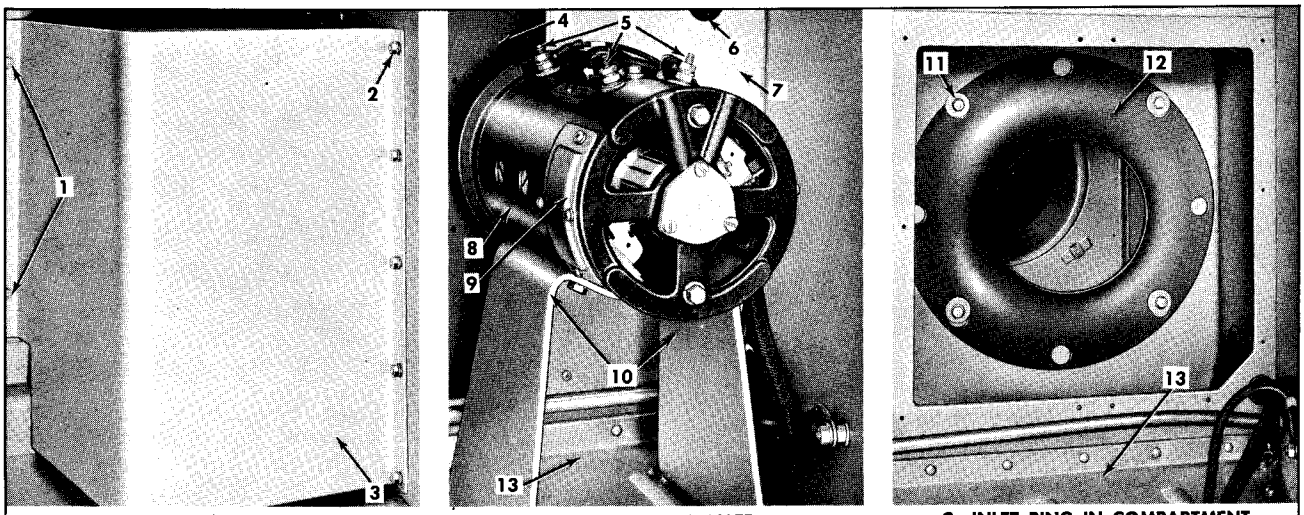


Figure 5—Blower Wheel and Air Inlet Ring Locations



A—MOTOR SHIELD INSTALLED
1 Shield Screws
2 Bolt Nuts and Washers
3 Motor Shield
4 Forward Closure Panel
5 Motor Terminals

B—MOTOR INSTALLED
6 Access Hole Plugs
7 Rear Closure Panel
8 L.H. Blower Motor
9 Motor Brush Cover

C—INLET RING IN COMPARTMENT
10 Motor Mounting Bracket
11 Air Inlet Ring Bolt
12 L.H. Blower Inlet Ring
13 Baggage Compartment Floor

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Figure 6—Left Hand Blower Motor Removal Views

REPLACING LEFT-HAND BLOWER MOTOR AND FAN UNIT

1. At left-hand side of coach open baggage compartment door behind left front wheel.

2. Referring to figure 6 remove the screws and bolts (1 and 2) which retain motor cover (View A), then remove cover.

NOTE: Condenser compartment must be opened to provide access to heads of bolts which hold motor cover to front baggage compartment wall.

3. Disconnect electrical wiring from motor terminals.

4. Remove screws which attach closure panels (View B, fig. 6) and remove front panel.

5. Remove four bolts which hold blower motor mounting bracket to floor.

6. Move blower motor, bracket and wheel assembly outward and remove from compartment. Rear closure panel can be removed after moving the blower motor assembly out of operating position.

7. To remove blower wheel from motor shaft, loosen the two set screws (fig. 4) at wheel hub, and slide wheel off motor shaft.

NOTE: Procedure for disassembling blower motor is given under "Blower Motor Repair."

8. To properly locate blower wheel on motor shaft and adjust air inlet ring-to-blower wheel clearance, follow the procedure as previously given in steps 7 through 10 under "Replacing Right-Hand Blower Motor and Fan Unit."

9. With electrical wiring connected to motor terminals, check motor operation.

10. Install blower compartment front closure panel (fig. 6).

11. Locate motor cover with holes aligned with bolt holes in compartment rear wall, then from condenser compartment insert bolts and install bolt nuts. Install screws which attach cover flange to blower compartment inner wall.

BLOWER MOTOR MAINTENANCE AND OVERHAUL

CLEANING

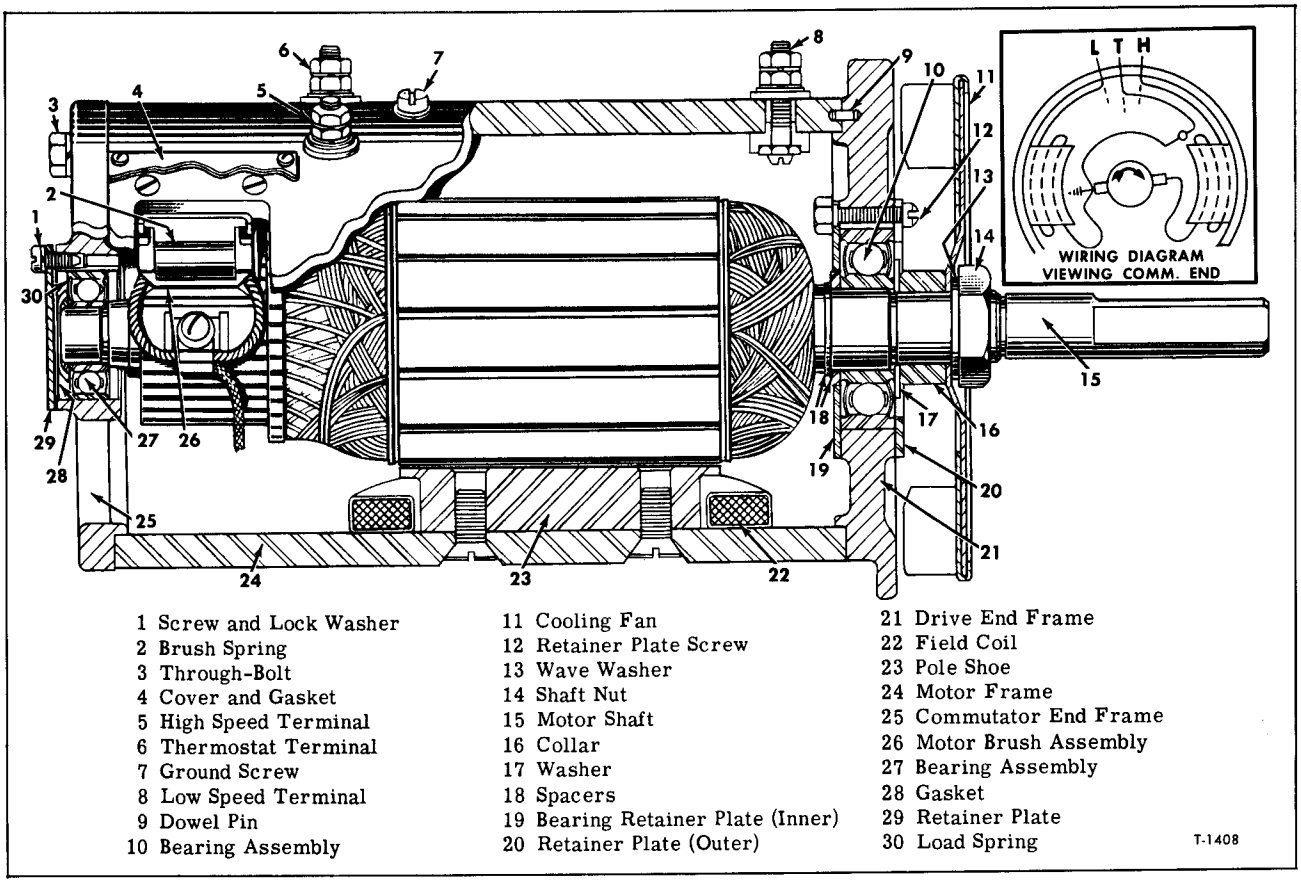
At regular intervals remove right-hand motor shield from compartment at right-hand side of coach and remove motor cover from left-hand blower motor (fig. 6). Wipe or brush off accumulated dirt from motors and mounting brackets. Also clean any dirt from adjacent areas.

INSPECTION

Whenever covers are removed to clean blower motors, observe motor commutator and brushes. If commutator is dirty, it may be cleaned with No. 00 sandpaper. (Do not use emery cloth.) Blow out all dirt with air hose after cleaning commutator.

If brushes appear excessively worn, follow the procedure given later under "Blower Motor Brush Replacement" to install new motor brushes.

If there is reason to suspect that blower motor speed is not high enough, refer to "Test Specifications" at end of section for checking instructions.



1 Screw and Lock Washer
2 Brush Spring
3 Through-Bolt
4 Cover and Gasket
5 High Speed Terminal
6 Thermostat Terminal
7 Ground Screw
8 Low Speed Terminal
9 Dowel Pin
10 Bearing Assembly
11 Cooling Fan
12 Retainer Plate Screw
13 Wave Washer
14 Shaft Nut
15 Motor Shaft
16 Collar
17 Washer
18 Spacers
19 Bearing Retainer Plate (Inner)
20 Retainer Plate (Outer)
21 Drive End Frame
22 Field Coil
23 Pole Shoe
24 Motor Frame
25 Commutator End Frame
26 Motor Brush Assembly
27 Bearing Assembly
28 Gasket
29 Retainer Plate
30 Load Spring

T-1408

Figure 7—Blower Motor Cross Section

REPLACING BLOWER MOTOR BRUSHES

When blower motor brushes have worn to point where brush replacement is necessary, it is recommended that the blower motor be removed from coach and disassembled to determine condition of motor bearings and commutator. Refer to "Blower Motor Overhaul" given later in this section for disassembly and assembly procedures.

NOTE: In an emergency the motor brushes can be replaced with motor installed. The brush cover plates (two on each motor) must be removed to gain access to brushes. Figure 8 shows typical procedure for removing the brushes from brush holder, while figure 9 shows brush holder, brushes and retaining parts. Screw and lock washer (3, fig. 9) must be removed to detach each brush from brush holder and leads.

BLOWER MOTOR SPEED CHECK

In event there is reason to suspect that blower motor speed is not normal or there is excessive current draw, the blower motor must be removed and "no-load" and resistance tests made to determine if motor assembly is functioning properly. Test specifications are given under "Specifications" at end of this section.

BLOWER MOTOR OVERHAUL

The two blower motors (right- and left-hand motors, figs. 3 and 6) are identical, each being a two-speed unit having three insulated terminals and a ground wire screw. Motors are protected by an internal thermal unit through which the respective magnetic switches are grounded. This feature is same as used on earlier coaches having the single blower motor. Figure 7 shows motor construction and identifies terminals. Motor removal procedure is given previously in this section under "Blower Motor Replacement."

BLOWER MOTOR DISASSEMBLY

Key numbers in following text refer to sectional view of motor (fig. 7) unless otherwise indicated.

1. Remove the four bolts and washers which attach motor to mounting bracket.
2. Remove the four screws and lock washers

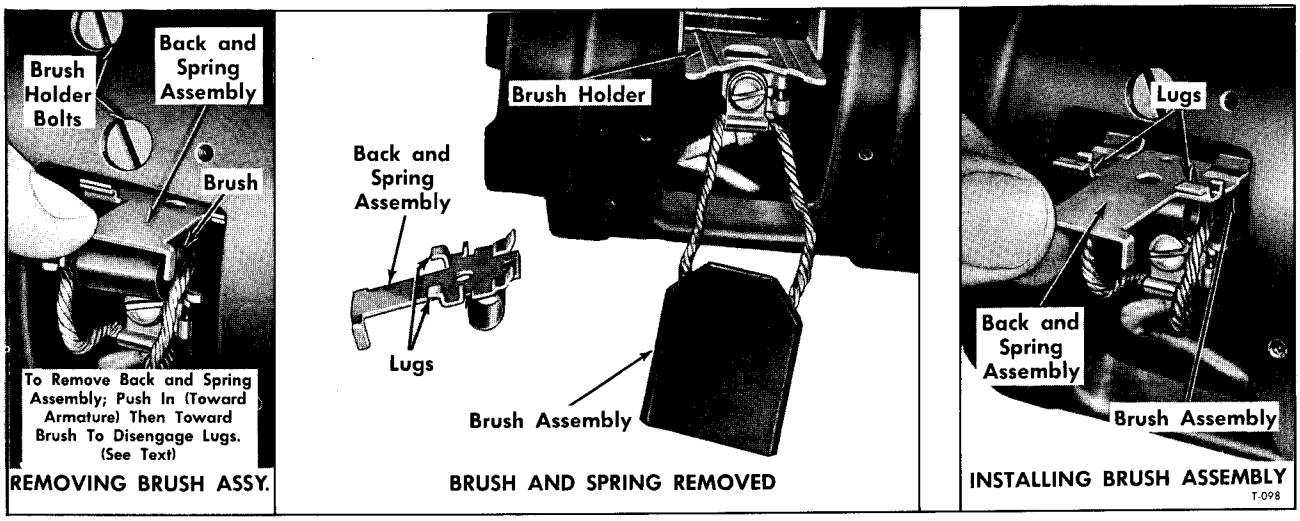


Figure 8—Replacing Blower Motor Brushes (Typical)

retaining each brush cover plate, then remove cover plates and gaskets (4).

3. Referring to figure 8, remove the back and brush spring assemblies and raise each brush out of holder. Remove the screw and lock washer holding brush heads to holders and remove brushes.

CAUTION: Never attempt to remove motor brushes by forcing brushes past the springs, as the brush springs may be damaged. Remove the back and spring assembly before removing brush.

4. Remove three screws and lock washers (1) attaching retainer plate (29) to end frame, then remove plate and gasket (29 and 28), and bearing load spring (30) from end frame (25).

5. Remove two through bolts (3) which secure the end frames (21 and 25) to motor frame (24).

6. Tap end frames with soft hammer to loosen from motor frame. Remove drive end frame (21) with shaft and armature (15).

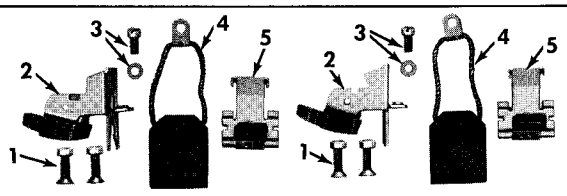


Figure 9—Brush Holders and Brushes Removed

7. Place box-end wrench on nut (14), then grip motor shaft (15) at flat surface in vise with soft jaws. Loosen and remove nut (14), washer (13), fan (11), and collar and washer (16 and 17) from shaft. Withdraw armature and shaft assembly from drive end frame bearing (10). Light pressure on end of motor shaft (15) may be required to force shaft out of bearing.

8. Remove spacers (18) from shaft.

9. Remove bearing retainer plate screws (12), and remove inner and outer retainer plates (19 and 20). Remove bearing assembly (10) from drive end frame.

NOTE: Normally it is not necessary to remove pole shoes (23), field coils (22) or brush holders (fig. 9) from the motor frame unless inspection indicates necessity for replacement of these components.

PARTS INSPECTION AND TEST

Before proceeding with repair operations, the following inspections should be made:

1. Check armature to commutator leads to be sure they are properly soldered. Loose leads should be resoldered using rosin flux rather than acid flux for electrical connections.

2. Inspect commutator and if found to be rough, out-of-round, worn, has high mica, or is badly burned, replace armature or repair commutator as instructed later under "Armature Repair."

3. Inspect field coil insulation. If insulation is cracked, charred, or worn so that wire is exposed, it is recommended that field coil and frame assembly be replaced.

4. Check length of brushes and replace if excessively worn. Be sure that pigtail leads are secure in the brushes and that terminals are properly fastened to leads.

5. Carefully inspect ball bearing assemblies for evidence of damage or wear. If rough, pitted, or worn; replace bearing assembly.

6. Inspect brush holder, back and spring assembly, and brush assembly for wear or damage. If either assembly is badly worn or broken, replace with new assembly. Brush spring tension should be 24 to 28 ounces.

Armature Test

1. With a conventional test light and prods, test armature for ground. Place one test prod on armature and other on commutator. If test light lights, armature is grounded and should be replaced.

2. If armature is open circuited, this can easily be detected visually, since an open circuit in the armature usually results in badly burned commutator bars.

3. To test armature for short circuit, place armature on growler connected to alternating current. Hold hack saw blade over armature while armature is rotated slowly. If saw blade vibrates or buzzes, armature is short circuited and should be replaced. However, before replacing an armature that is apparently shorted, inspect commutator slots for copper or brush dust deposits, clean thoroughly, and re-test.

4. Test armature terminal circuits for continuity. Place one test prod on armature terminal and other on terminal of each wire. If test lamp fails to light, wire is open circuited and should be replaced.

Armature Repairs

1. To turn down commutator, center armature in lathe; then machine until rough or worn spots or out-of-round condition has been removed.

CAUTION: Do not machine more than necessary. Commutator must not be turned down to less than 2.9375" in diameter.

2. Mica between commutator segments must be below surface of segments. If this condition does not exist, undercut mica until it is 1/32" below surface of segments. After undercutting, use No. 00 sandpaper to clean and smooth up commutator, then use compressed air to remove all fine particles of cuttings.

NOTE: When undercutting mica between commutator bars, use a tool which will make a clean cut to full width of mica insulation.

ASSEMBLING BLOWER MOTOR

Key numbers in following text refer to sectional view of motor (fig. 7) unless otherwise indicated.

1. Install bearing (10) in drive end frame (21) and assemble inner and outer retainer plates (19 and 20) to end frame using screws (12) with nuts at inner plate (19).

2. With spacers (18) in place on shaft, install end frame and bearing assembly on shaft. In the order listed, install washer (17), collar (16), fan (11), and wave washer (13); then install nut (14) and while shaft (15) is gripped in vise, tighten shaft nut to 75 to 90 foot-pounds.

3. Install bearing assembly (27) on commutator end of motor shaft, then with pole shoes (23) and field coils (22) in motor frame (24), set the motor frame assembly in place over armature. Dowel pin (9) locates motor frame at end frame.

4. Install commutator end frame, carefully fitting the end frame over bearing assembly (27). Tap lightly on end frame with soft hammer to seat the end frame at motor frame (24). A dowel pin is used to locate the parts correctly.

5. Install the two through-bolts (3) with lock washers and tighten firmly to seat all mating parts solidly.

6. Place load spring (30) against bearing (27), and install retainer plate (29) and gasket on commutator end frame (25) using screws and lock washers (1).

7. Set brush assemblies (26) in holders-in position so brushes make full contact at commutator. If brushes are installed improperly, only the point of brushes will make contact at commutator. Connect brush leads, field coil wires and thermal unit ground wire at respective brush holder terminals using screw and lock washer.

8. Install brush covers using new gaskets.

HEATING SYSTEM WATER BOOSTER PUMP

GENERAL

The heating system water booster pump is essentially the same as used on earlier production coaches; however, additional information on motor brush installation as well as overhaul and inspection procedure is included below. Refer to figure 2 for installed position of pump and to figure 10 for sectional view of pump and motor assembly.

CAUTION: Never operate the pump dry, as pump seal will be destroyed.

PUMP AND MOTOR OVERHAUL

(Key numbers in text refer to figure 10.)

DISASSEMBLY

1. Remove two brush caps (3) and two brush and spring assemblies (4).

2. Remove pump cover (9) by removing eight

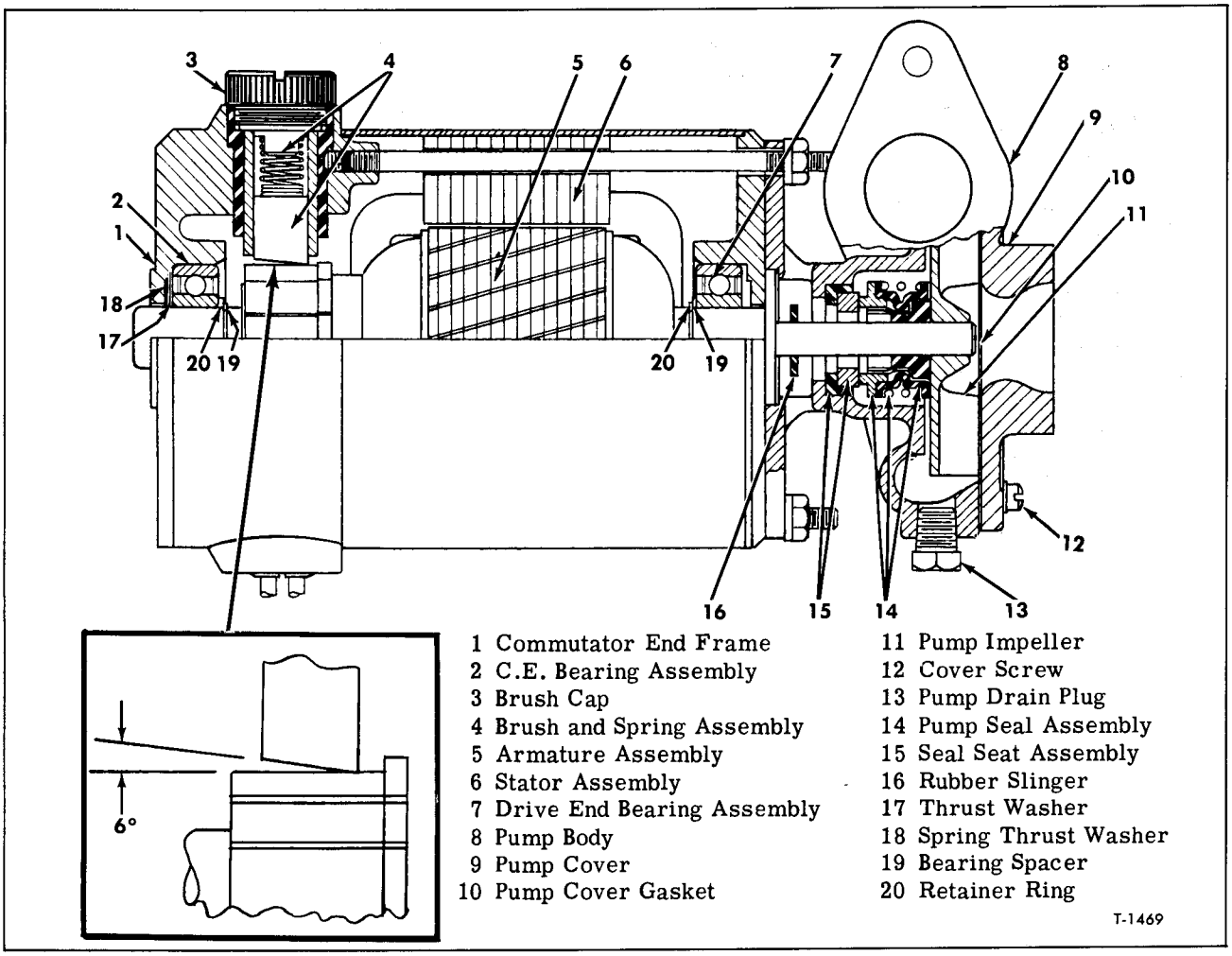


Figure 10—Heating System Water Booster Pump and Motor

fillister head screws. Remove cover carefully to prevent damage to gasket (10).

3. Remove gasket (10).

4. Remove two hex nuts, and lock washers which attach pump assembly to motor.

5. Remove pump from motor in the following manner:

a. Install puller tool assembly (80-0202) to pump body (8) using four of the screws which were removed from the pump cover (9).

b. Tighten the puller screw which will press the motor shaft out of the impeller hub. The pump proper is now free of the motor.

6. Remove the puller tool.

7. Remove the impeller (11) and components of seal (14 and 15) assembly. (CAUTION: Do not damage the raised shoulder of the seal washer.)

8. Remove the floating seal seat (15) from the pump body by gently pressing from the motor side of the body.

CAUTION: Do not scratch or mar the sealing surface of this seat.

INSPECTION (Refer to Fig. 10)

Compare components with new parts to determine degree of wear.

Brushes

1. When removing brushes note the position of the brush in the tube. Brush life is shortened if brushes are not replaced properly.

2. Brushes should be examined for:

a. Wear. Replace if less than 25% of the usable brush is left (less than .300 of an inch).

b. Chipped Edges. Chips can be caused by improper handling or installation. Badly chipped brushes should be replaced regardless of length.

c. Annealed Brush Spring. Annealing can be detected by noting the resiliency of the spring. Annealing is caused by failing to tighten brush caps properly, thus not providing a good low resistance contact between the terminal and brush tube. Brushes evidencing annealed springs should be replaced.

d. Frayed or Broken Pigtail. An improperly installed brush may have the pigtail (shunt) pinch-

ed under the terminal or between the coils of the spring.

3. When replacing brushes the following items are important:

a. The face of a new brush is carefully cut to cause proper seating during the "wear-in" period.

b. Improper installation can harm both the brush and the commutator.

c. Replacement brushes should be of the proper grade.

d. New brushes have a 6^{o} angle on the brush face. The brush should always be inserted so the angle is open away from the pump end of the assembly (see fig. 14).

e. Brush performance is degraded if the spring and terminal are not properly placed in the tube. The spring should be free over its entire length and the terminal should make good contact with the metal brush tube insert.

Bearings

1. Rotate motor shaft. If ball bearings show evidence of wear, they should be replaced.

2. When removing armature from motor, the number of washers and their arrangement should be noted. Improper number or installation of washers can cause improper tracking of brushes, excessive preloading of bearings and noisy operation. Spacer (19) and retainer ring (20) must be located as shown.

3. The use of bearing puller tool is recommended when removing bearings, to prevent damage to the armature winding or commutator.

4. Replacement bearings should be pressed to the same exact location as the original installation.

5. The use of a suitable sealant (such as Loctite or equivalent) is recommended between the shaft and bearing if the fit does not seem tight enough to prevent the shaft from spinning inside the inner race.

6. After replacing bearings, the position of the commutator in the motor can be checked by looking down the brush tube. Neither the riser nor the edge of the commutator should be visible.

Commutator

1. Commutator is a precise assembly. Although solidly built of fairly tough material it is easily ruined by careless handling.

2. Refinishing should be done only on equipment which will provide good concentricity and the proper finish.

3. Refinishing should be done if a micrometer reading shows a difference between "in track" and "off track" diameter of .187" or more.

4. The commutator should be carefully undercut with a .025" or less slot width.

5. A 25 to 50 microinch finish is desirable on a new or refinished commutator.

6. Commutator should not be touched with the fingers as sweat and body oils rapidly discolor and oxidize the surface.

Miscellaneous

1. Check the rubber shaft slinger (16) to make sure it is tight on the motor shaft. If it slips on the shaft it should be replaced.

2. Inspect the seal and seat assemblies (14 and 15) to determine wear. If the seal has leaked, or is badly worn, installation of a complete new assembly is recommended. However, in an emergency, or if a completely new seal assembly is not at once available, a new component may be installed to replace the damaged member. This procedure should be followed only when a complete new seal assembly is not available.

3. The impeller (11) is a press fit on the armature shaft. This press fit must be maintained to prevent the impeller from slipping. Install a new impeller if necessary.

ASSEMBLY (Refer to Fig. 10)

1. Install floating seal seat (15) in the pump body (8) in the following manner:

a. Clean seat in gasoline or some cleaning solvent to remove any dust or dirt.

b. Insert the seat in the proper recess in the pump body. This is a snug fit, but a drop of machine oil or a small amount of clean grease applied only to the neoprene ring and to the body cavity will insure easy installation. Be sure the seat bottoms in the pump body around its entire circumference.

2. Install slinger (16) on motor shaft.

3. Assemble body (8) to motor.

4. Lubricate pump shaft with a small amount of light oil then slip seal bellows and washer assembly (14) onto shaft so that the seal washer contacts the seal seat (15) in the pump body (8).

5. Install impeller (11) in following manner:

a. Place impeller on flat surface with vanes against the flat surface.

b. Invert motor and pump body assembly and pilot pump shaft into impeller bore. DO NOT HAMMER on the motor shaft extension at rear of motor.

c. Press motor and pump body until the machined face of pump body is flush with the face of flat surface on which the impeller is resting. The face of impeller vanes must now be flush with machined face of the pump body.

6. Install gasket (10). This gasket is .010" thick and serves both to seal the cover and to establish proper clearance between the face of the impeller and the pump cover.

7. Attach cover (9) to pump body using eight fillister head screws (12).

8. Install motor brushes (4) and brush caps (3), observing the precautions mentioned previously in item 3. under "Inspection."

HEATING AND VENTILATION

GRAD-U-STAT

Information in Maintenance Manual X-6114 pertaining to Grad-U-Stat description and operation is applicable to current vehicles.

The following text and illustrations include revised instructions for test and adjustment of the Grad-U-Stat; and also provides instructions for disassembly and assembly of the unit.

TEST AND ADJUSTMENT (IN COACH)

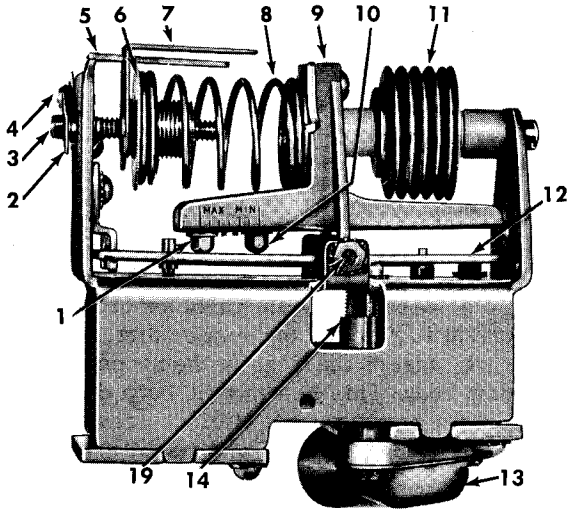
NOTE: Grad-U-Stat can be tested and adjusted in coach as follows or it can be removed from coach and shop tested as directed later under "Grad-U-Stat Shop Test."

Key numbers in text refer to figure 11.

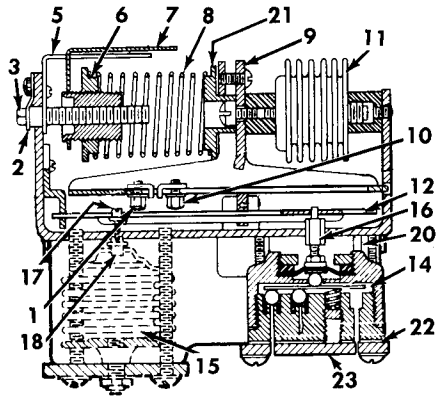
1. Shut off air supply to Grad-U-Stat at pressure regulator valve located at forward side of air conditioning evaporator (fig. 3). Turn adjusting knob completely counterclockwise to shut off air.

2. Remove plug from line elbow at Grad-U-Stat, then install air pressure test gauge.

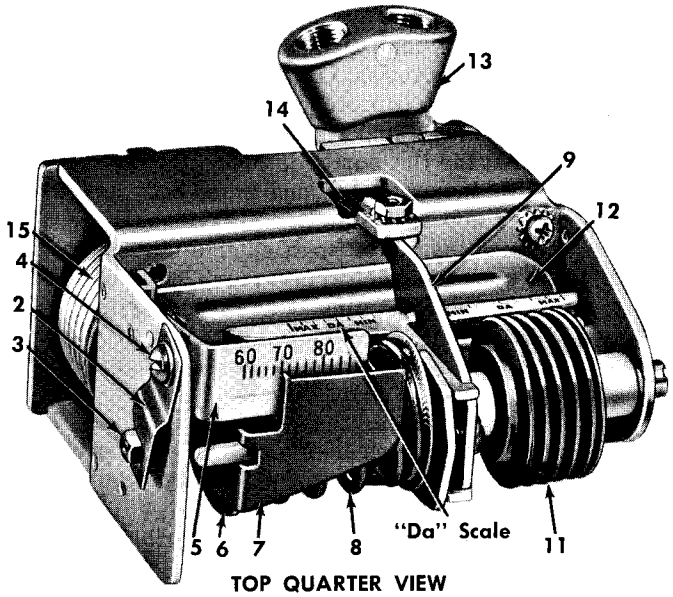
3. Open air supply to unit by turning air pressure regulator valve adjusting knob clockwise, until pressure gauge at air pressure regulator valve indicates 17 pounds pressure.



BOTTOM SIDE VIEW



CROSS SECTION VIEW



TOP QUARTER VIEW

1 Barometric Bellows Adjustment Button
2 Locking Latch
3 Adjusting Screw
4 Latch Attaching Screw
5 Scale
6 Calibration Nut
7 Indicator
8 Main Spring
9 Main Lever
10 Differential Range Adjustment Button
11 Temperature Bellows
12 Secondary Lever
13 Air Line Manifold
14 Air Valve Assy.
15 Barometric Bellows
16 Extension Nut
17 Barometric Bellows Linkage Screw
18 Linkage Lock Nut
19 Main Lever Pivot Screws
20 Spacer
21 Spring Seat
22 Gasket
23 Support Plate

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Figure 11—Heating System Grad-U-Stat Assembly

4. With engine warmed up to normal operating temperature, the blowers operating, doors and windows closed, and with defroster blower off, check the air temperature at the bellows with an accurate thermometer.

> IMPORTANT: Do not touch the bellows with hand while performing the following operation, as body heat will affect both units and erroneous readings and adjustments will be obtained.

5. Loosen locking latch screw (4), disengage latch (2) from adjusting screw (3); then turn the adjusting screw to set the indicator at the temperature shown on the thermometer.

6. Observe pressure reading on air pressure test gauge. If reading is 8 pounds, no adjustment is required. If pressure is above 8 pounds, turn the calibration nut (6) and main spring (8) to shorten the spring until the correct reading (8 pounds) is obtained. NOTE: Compress spring when turning nut against increased spring compression. Release hand pressure on spring when checking readings. If pressure is below 8 pounds, turn calibration nut and main spring in opposite direction to lengthen the spring (spring compression not necessary).

7. After correct adjustment is obtained, turn adjusting screw (3) to set the indicator at desired operating temperature (75^{O}F. is factory setting), place locking latch (2) over adjusting screw, and tighten latch screw (4).

8. To check the differential range, find the temperature setting on scale (5) at which the pressure in line to water valve is 3 psi and the temperature setting at which line pressure is 13 psi. The number of degrees the setting must be changed to raise line pressure from 3 to 13 psi is the approximate differential range. For example: At 3 psi, the temperature indicator may point to 75^{O}F. and at 13 psi it may point to 71^{O}F. If this were the case, the differential range would be 4 degrees.

IMPORTANT: If the differential range is adjusted too low, hunting or cycling from hot to cold will occur. If necessary change as follows:

a. Using a small open-end wrench, loosen the differential range button (10) between the "MAX." and "MIN." positions. Move the button to the desired position on its scale, and retighten range button.

b. Make sure differential range button is between the "MAX." and "MIN." markings on side of main lever (9). Maximum range is 10 degrees, minimum range is 3 degrees.

NOTE: After making the above check and adjustment reset the temperature indicator to 75^{O}F. on scale (5).

9. To check the valve unit and levers, move the free end of the main lever (9) first to one stop and then to the other. releasing it each time and watching the air pressure gauge. When the lever is moved against its stop, the gauge should show a decisive and immediate air change from 8 pounds to either 0 pounds or 17 pounds, depending on which direction the lever was moved. If the above tests indicate that the Grad-U-Stat is faulty, proceed to remove the unit from coach for disassembly as the air valve assembly (14) is most likely the cause of trouble.

10. To check operation of air valve only when unit is installed proceed as follows:

a. Mark the location of differential range button (10) so that it can be returned to original location later, and loosen and move the button to "MAX." on the direct-acting "DA" side of the main lever (9). Move the main lever (9) from one stop to the other while observing the time required for the air pressure, as shown on air pressure gauge, to build up and bleed down. The build-up and bleed-down time should be the same. Adjust the extension nut (16), if necessary, until these conditions are met. Check the timing as outlined above with the differential range button at "MIN." In each case, build-up and bleed-down time should be the same. Continue checking and adjusting the extension nut (16) until the timing on both settings is equal. If adjustment of the extension nut does not provide equal build-up and bleed-down timing, remove Grad-U-Stat and replace air valve assembly as directed later. If equal timings are obtained, seal the extension nut in place with household cement or fingernail polish, taking care to keep the sealer out of the air valve assembly (14). Move the differential range button (10) to its original position on "DA" side of main lever (9), as indicated by mark previously made, and tighten in place.

b. Recalibrate Grad-U-Stat as outlined previously in steps 5, 6, and 7.

11. The barometric bellows (15) will seldom need attention. If it becomes ruptured, it may cause overheating. The bellows may be checked by removing it from Grad-U-Stat, as outlined later under "Disassembly of Grad-U-Stat." and applying pressure gently while holding it under water. Bubbles will indicate leaks and the barometric bellows should be replaced.

It will not be necessary to readjust the barometric bellows (15) unless the barometric bellows linkage screw (17) or button (1) has been turned or a new bellows is installed.

a. To adjust the barometric bellows (15), first loosen the barometric linkage locknut (18) using small open-end wrench and small screwdriver, then back off the barometric bellows linkage screw (17) until the bellows adjustment button (1) no longer touches the secondary lever (12). Then calibrate the Grad-U-Stat as described previously in steps 5, 6, and 7. NOTE: In order to gain access to lock nut with wrench, it is necessary to remove the

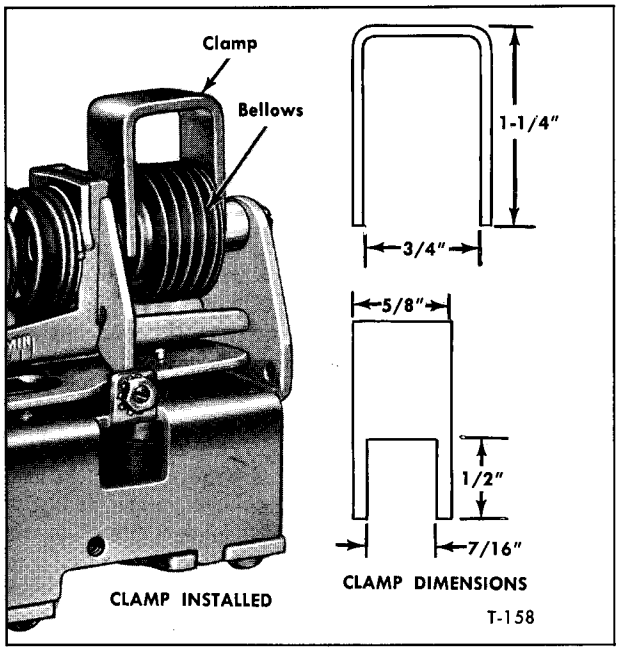


Figure 12—Bellows Clamp Installed

Grad-U-Stat mounting bracket at the end of Grad-U-Stat.

b. Loosen barometric bellows adjustment button and position midway between "MAX." and first mark below "MAX." on secondary lever (12). Tighten button in place.

c. Hold the main lever (9) against its bottom stop to compress the temperature bellows (11) to its maximum.

d. Adjust the length of the barometric bellows (15) by turning the barometric bellows linkage screw (17) until the barometric button (1) just touches the secondary lever (12), then lengthen barometric bellows linkage screw (17) one full turn. The friction-fit barometric linkage locknut (18) is then tightened.

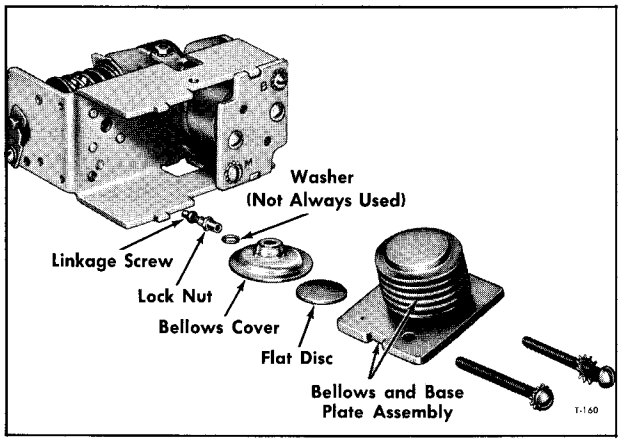


Figure 13—Barometric Bellows Components

12. Remove test gauge, then install plug in air line tee.

13. Open air supply to Grad-U-Stat.

DISASSEMBLY OF GRAD-U-STAT

NOTE: Key numbers in text refer to figure 11.

1. Place a bellows clamp on the temperature bellows (11) to prevent over-expansion of the bellows (fig. 12) when it is removed. NOTE: Clamp can be fabricated locally from 3/32-inch stock using dimensions shown in figure 12.

2. Loosen locking latch screw (4), disengage latch (2), from adjusting screw (3), then turn adjusting screw clockwise until the indicator (7) is at its low end and the tension on the main spring (8) is relieved. Slip out the main spring (8) spring seat (21) and indicator assembly (7). If necessary, loosen scale (5) mounting screw.

3. Temperature bellows (11) may be removed by removing bellows mounting screw on both ends of bellows.

4. Loosen main lever pivot screws (19) and lift out main lever (9).

5. Remove the two screws holding the secondary lever (12) and lift out secondary lever. It may be necessary to loosen the indicator bracket screw before lifting out the secondary lever if the lock washer under this screw overlaps the lever. Remove barometric linkage screw (17) with small flat washer, bellows cover and flat disc. These components are shown in figure 13.

6. Mark air line manifold (13), air valve assembly (14), support plate under air valve assembly and Grad-U-Stat frame, to ensure proper placement in assembly (fig. 14).

7. Remove air line manifold (13) by removing two mounting screws, taking care not to damage sealing surfaces.

8. Remove air valve assembly (14) by unscrewing two screws holding valve and its support plate (23) to Grad-U-Stat frame. Remove U-shaped spacer (20).

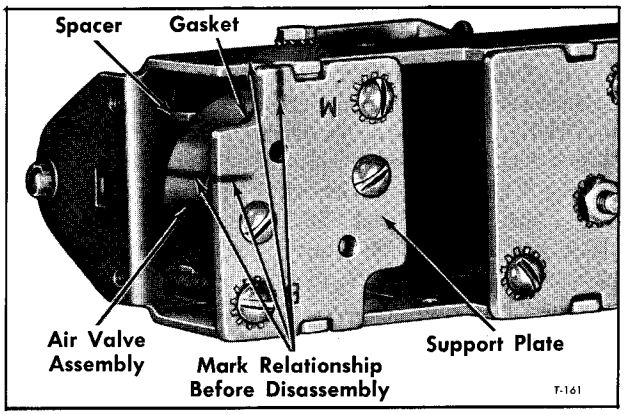


Figure 14—Grad-U-Stat Air Valve Installed

9. Remove air valve assembly (14) from its support plate by removing two attaching screws, taking care not to damage sealing surfaces.

10. Remove barometric bellows (15) with base plate by unscrewing the two screws that hold it in place. Figure 13 shows bellows removed.

NOTE: Bellows can be checked as directed previously under "Tests and Adjustments." See step 11.

ASSEMBLY OF GRAD-U-STAT

NOTE: Key numbers in text refer to figure 11.

1. Clean and inspect all parts before assembling Grad-U-Stat.

2. Lubricate pivot points.

3. Assemble secondary lever (12) and tighten two brass attaching screws. NOTE: Make sure lever is mounted at bottom of screw slots.

4. Install the main lever (9) in place and secure by tightening main lever pivot screws (19). The main lever pivot screws should allow from 0.005" to 0.010" side play of main lever to prevent binding.

5. Install temperature bellows (11) in place using attaching screw with internal-teeth lock washer at stationary bracket and regular lock washer at main lever screw. DO NOT REMOVE BELLOWS CLAMP.

6. Slip main spring (8) with main spring seat (21), and indicator assembly (7) in place.

7. Remove bellows clamp.

8. Install the air valve assembly (14) and its support plate and spacer (20) in the Grad-U-Stat frame with four screws, to alignment marks made at disassembly. Make sure the pin on the extension nut (16) goes through the hole in the secondary lever (12). Don't force the air valve assembly in place; screw down extension nut, if necessary. If pin does not fit loosely in secondary lever hole, realign secondary lever (12) by pressing on one side with screwdriver.

NOTE: The valve unit spacer (20) should be installed with the open end of horseshoe shape facing out as shown in figure 14. Purpose of spacer is to prevent distortion of valve support plate which would cause leaking.

Should a replacement air valve assembly (14) be installed, place a new gasket (fig. 14) on bottom of air valve. Make certain that new unit is properly oriented by observing relationship between mark made on old unit in disassembly and holes in bottom of air valve assembly. Place mark on new unit to match mark on old unit to insure proper installation of new air valve assembly with its support plate, air line manifold (13) and Grad-U-Stat frame.

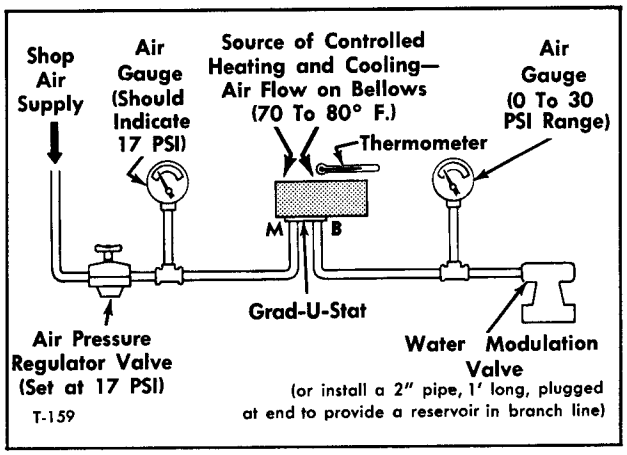


Figure 15—Grad-U-Stat Shop Test Arrangement

9. Using a new gasket if required, install air line manifold (13) by aligning marks made at disassembly. Tighten two mounting screws evenly to prevent air leakage.

10. Install barometric bellows (15) by inserting barometric bellows linkage screw (17) with lock nut into hole in secondary lever (12). Install bellows cover, flat disc, and bellows with base plate. Install two screws that hold barometric bellows base plate to Grad-U-Stat frame. Figure 13 shows components removed.

Grad-U-Stat can be shop tested before installing in coach if desired, as directed below:

GRAD-U-STAT SHOP TEST

If the coach system is inoperative and there is no way to simulate operational conditions, a shop test will be required to check Grad-U-Stat. Figure 15 shows typical arrangement of equipment necessary to shop test unit.

1. Install Grad-U-Stat in shop test equipment as shown in figure 15.

2. A heat fan and an ordinary cooling fan or source of controlled ambient temperatures are necessary to check Grad-U-Stat.

3. Proceed to make checks and adjustments in same manner as directed previously under "Tests and Adjustment" when Grad-U-Stat is installed in coach.

SPECIFICATIONS

Specifications on heating and ventilation units contained on page 43 (SEC. 3), in Maintenance Manual X-6114 are applicable to early and late production coaches, except for "Under Floor Blower Motor." Specifications for blower motors used on late production vehicles are given below:

BLOWER MOTORS (LATE PRODUCTION COACHES)

Make	Delco-Remy
Stamped	1114644
Type	12V., 2-Field, 2-Speed
No. Motors Used	2
Rotation (At Shaft End)	CCW
Brush Spring Tension	24 - 28 oz.

Test Specifications (No Load)

High Speed Test

With 13.5 volts applied across "H" terminal to ground, the cold, free running motor performance should be 4600 - 5000 RPM at 23 amperes maximum.

Low Speed Test

With 13.5 volts applied across "H" terminal to ground screw and with "L" terminal connected to "H" terminal, the cold, free running performance should be 2350 - 2600 RPM avg. at 20 amperes maximum.

Resistance Test

With 6 volts applied across "H" terminal to ground screw and with armature locked, current flow should be 160 - 180 amperes.

Shunt Coil Test

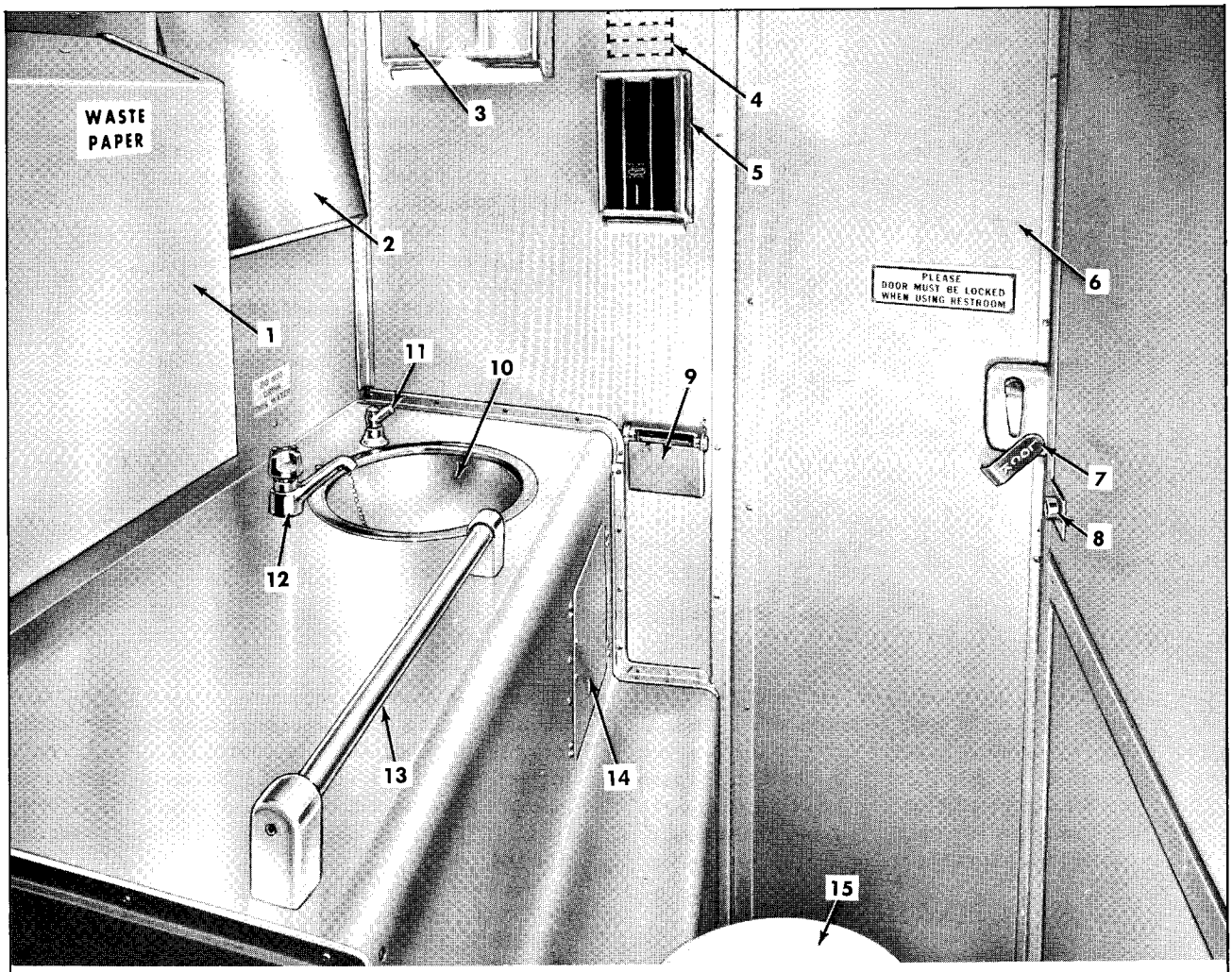
With 13.5 volts across "L" terminal to ground screw, current flow should be 1.5 - 1.7 amperes.

Lavatory

DESCRIPTION

Lavatory and toilet facilities are provided for passenger comfort and convenience (fig. 1) as special equipment. Lavatory is located at right rear corner of coach. Lavatory compartment is equipped with wash basin, chemical toilet, liquid soap dispenser, mirror, waste paper container, toilet tissue dispenser, paper towel dispenser, ash tray, and on some coaches a sanitary napkin dispenser. Figure 2 illustrates schematic layout of lavatory plumbing.

An electric motor driven blower, shown in figure 3, is used to exhaust odors from lavatory compartment. A 13.5 gallon polyethylene water supply tank, mounted behind lavatory rear wall over wash basin, supplies water to wash basin through a faucet by gravity feed. A 13 gallon wash



1 Waste Paper Container
2 Mirror
3 Towel Dispenser
4 Sanitary Napkin Dispenser Location (When Equipped)
5 Toilet Tissue Dispenser
6 Compartment Door
7 Compartment Door Inside Lock
8 Emergency Switch (To Signal Driver)
9 Ashtray
10 Wash Basin
11 Soap Dispenser
12 Water Faucet
13 Hand Rail
14 Service Compartment Access Door
15 Lavatory Stool

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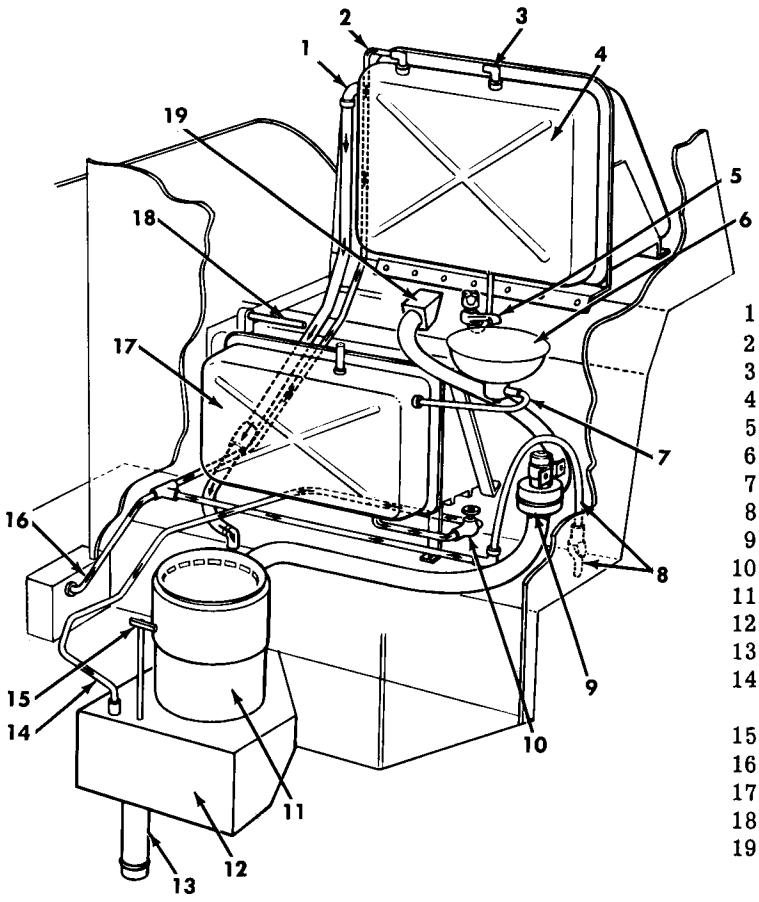
Figure 1—General Arrangement of Lavatory

LAVATORY



1 Supply Tank Overflow Line
2 Tank Supply Line
3 Supply Tank Vent
4 Wash Basin Supply Tank
5 Faucet
6 Wash Basin
7 Basin to Waste Tank Line
8 Cleaning Hose & Pressure Nozzle
9 Blower and Motor Assembly
10 Wash Basin Drain Tank Drain Valve
11 Toilet Stool
12 Chemical Tank
13 Chemical Tank Drain
14 Wash Basin Waste Tank to Chemical Tank Line
15 Chemical Tank Drain Plug Handle
16 Service Hose Connector
17 Wash Basin Waste Tank
18 Assist Handle
19 Blower to Engine Air Intake Exhaust

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Figure 2—Schematic of Lavatory Water Lines and Units

basin waste tank, mounted in service compartment below wash basin, is emptied into the chemical waste tank by opening a drain valve in the service compartment. The 10-1/2 gallon chemical waste tank, located directly below the lavatory compartment, has facilities for emptying beneath the coach, thus preventing odors from entering the coach.

OPERATION

Whenever possible, automatic controls are provided for maximum passenger safety, comfort and privacy. Following information describes purpose and function of individual units.

VENTILATOR BLOWER

Ventilator blower, mounted in lavatory service compartment below the wash basin as shown in figure 3, forces odors from the lavatory compartment to the engine air intake.

Blower operates whenever engine is running or whenever lavatory is occupied with door locked from the inside. Motor is energized through a relay located in the electrical apparatus compartment at right rear side of coach. See item 16 in figure 6 in ELECTRICAL (SEC. 7) in Maintenance Manual X-6114.

A 6-amp line fuse is installed in blower motor feed wire near blower motor (fig. 3). Refer to "WIRING AND MISCELLANEOUS ELECTRICAL" (SEC. 7) in Maintenance Manual X-6114, for description of lavatory control relay and the blower relay. All relay circuits are shown on "Lavatory Wiring Diagram - MD-93902" in back of this manual.

LAVATORY BLOWER RELAY

Blower relay controls lavatory blower motor and is located in electrical apparatus compartment at right rear side of coach. Circuit through relay is explained under "Relays" in "WIRING AND

MISCELLANEOUS ELECTRICAL" (SEC. 7) in Maintenance Manual X-6114. Refer to "Lavatory Wiring Diagram - MD-93902" in back of this manual.

LAVATORY CONTROL RELAY

Lavatory control relay, which controls circuit to lavatory lights and units, is located in electrical apparatus compartment at right rear side of coach. See item 17 in figure 6 in ELECTRICAL (SEC. 7) in Maintenance Manual X-6114. Circuit through relay is explained under "Relays" in WIRING AND MISCELLANEOUS ELECTRICAL (SEC. 7) in Maintenance Manual X-6114. Refer to "Lavatory Wiring Diagram - MD-93902" in back of this manual.

LAVATORY EMERGENCY BUZZER

Lavatory emergency buzzer is mounted on panel under dash in front of driver as shown in figure 56 in "LAVATORY" (SEC. 3) in Maintenance Manual X-6114. Buzzer is operated by push-button type switch marked "TO SIGNAL DRIVER - EMERGENCY ONLY" located on transverse partition of lavatory compartment (fig. 1). To check circuit continuity, refer to "Lavatory Wiring Diagram - MD-93902" in back of this manual. If buzzer becomes defective, it must be replaced.

EMERGENCY BUZZER SWITCH

Emergency buzzer switch marked "TO SIGNAL DRIVER - EMERGENCY ONLY" is located on transverse partition of lavatory compartment as shown in figure 1.

DOME LIGHTS

Three dome lights are mounted in ceiling of the lavatory. Center light is connected to coach marker light circuit and is illuminated whenever marker lights are turned on. The other two lamps are illuminated only when lavatory is occupied and door is closed and locked. For circuit continuity refer to "Lavatory Wiring Diagram - MD-93902."

LAVATORY DOOR LOCK

Door lock, installed on lavatory door, is the same as previously covered in "LAVATORY" (SEC. 3) page 51 in Maintenance Manual X-6114.

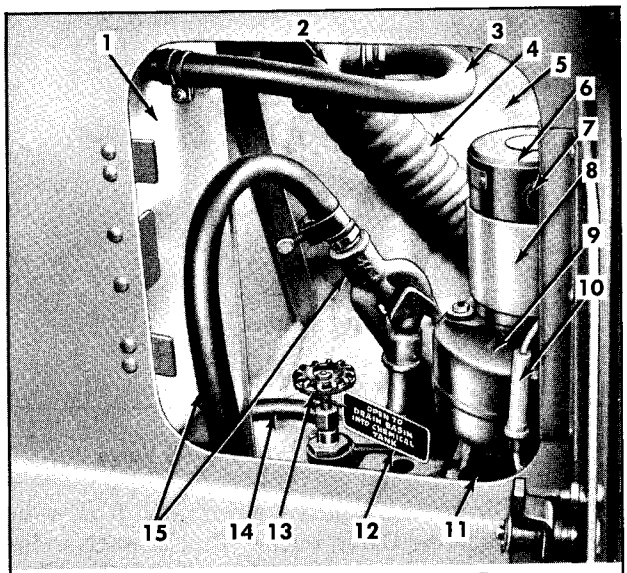
DOOR LOCK SWITCH

Door lock switch is the same as previously covered in "LAVATORY" (SEC. 3, page 51) in Maintenance Manual X-6114. For circuit continuity, refer to "Lavatory Wiring Diagram - MD-93902" in back of this manual.

MAINTENANCE

GENERAL

Lavatory filling and flushing service line fitting is accessible after opening access door at



1 Wash Basin Waste Tank
2 Wash Basin Trap
3 Wash Basin Trap to Waste Tank Hose
4 Blower to Engine Air Intake Hose
5 Service Compartment
6 Blower Motor
7 Brush Cap
8 Mounting Strap
9 Blower
10 6-Amp. Fuse
11 Air Intake Tubing
12 Instruction Tag
13 Basin Waste Tank Drain Valve Assy.
14 Basin Waste Tank to Chemical Tank Hose
15 Flushing Hose Assy.

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Figure 3—Lavatory Service Compartment

right rear side of coach (fig. 4). End of line is equipped with a quick release coupling fitting to which a flexible service hose with a mating coupling can be attached for servicing tanks.

Hose coupling, which is of the Hansen 6000 Series, can be obtained at your local Hansen dealer or can be ordered from Hansen Manufacturing Co., 4031 West 150th St., Cleveland, Ohio.

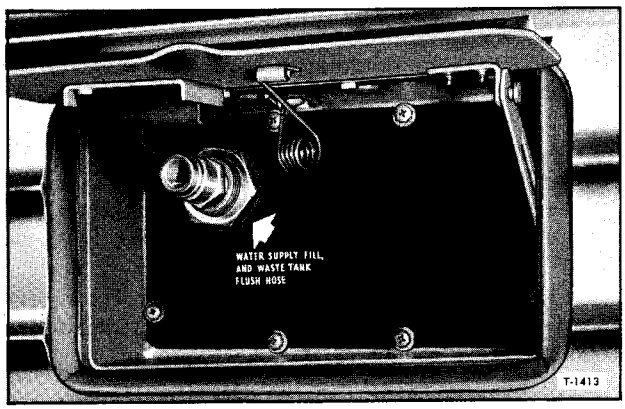


Figure 4—Lavatory Water Service Fitting

LAVATORY

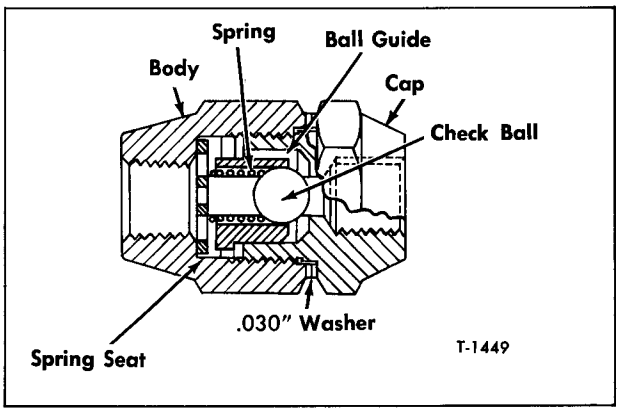


Figure 5—Water Supply Tank Check Valve

Coupling hose can be purchased locally or ordered from the Gates Rubber Co., Denver, Colorado.

For the purpose of draining the chemical tank, special connectors and fittings, shown in figures 61 and 62 in "LAVATORY" (SEC. 3) page 54, in Maintenance Manual X-6114, are available from the Service Parts Department, General Motors Truck & Coach, Pontiac, Michigan.

NOTE: Instructions for draining the entire system are explained later. See "Draining of Entire Lavatory System."

WASH BASIN SUPPLY TANK

The polyethylene wash basin water supply tank is constructed with two fittings at top of the tank and a fitting at the side and bottom of the tank which determine the water level in tank at which the tank will overflow and the level at the outlet to the water faucet when tank is empty.

Tank is equipped with a one way check valve and elbow at top of tank. Upon filling tank, the check valve remains closed. Air and water is exhausted through the overflow line and a rubber trap underneath coach. The trap acts as a one way check valve, allowing the exhaust of air and water. When water is being drained from tank by water faucet, air is admitted into tank through the check valve to displace outgoing water.

Periodically, the check valve should be removed, operation checked, disassembled and cleaned. Operation can be checked by attempting to pass air through the valve both ways. Air should pass through valve only in direction of arrow stamped on side of valve body. Figure 5 shows components of valve.

IMPORTANT: When reinstalling valve, make sure arrow on side of valve is pointed toward tank elbow.

Filling Supply Tank

1. Lift access door over service line fitting at right rear of coach (fig. 4), then connect water supply hose to fitting marked "WATER SUPPLY FILL AND WASTE TANK FLUSH HOSE."

2. Fill supply tank with CLEAN, fresh water until water starts to flow out overflow line (fig. 2).

3. After filling tank, disconnect water supply hose, then close access door at service fitting.

LAVATORY CHEMICAL TANK

NOTE: Procedures for draining chemical tank, sealing chemical tank, and adjusting chemical tank drain plug are the same as previously covered in "LAVATORY" (SEC. 3, pages 55 and 56) in Maintenance Manual X-6114.

Flushing Chemical Tank

NOTE: Make sure chemical drain plug is removed from bottom of tank.

1. Lift access door over service line fitting at right rear of coach (fig. 4), then connect water supply service hose to fitting.

2. Open water pressure into fitting, then within the lavatory compartment, open small door on riser panel at right of basin (fig. 3) for access to flexible flushing hose.

3. Remove hose from compartment, then direct water spray into toilet stool and chemical tank until flushing is completed.

4. Leave water supply service hose connected until after tank is chemically treated.

Filling and Treating Chemical Tank

Procedures for filling and treating the chemical tank are the same as previously covered in "LAVATORY" (SEC. 3, page 56) in Maintenance Manual X-6114, except refer to figure 3 for location of flushing hose and fill chemical tank through lavatory stool with approximately 1-1/2 gallons of water instead of 6-1/2 gallons as previously recommended.

WASH BASIN WASTE TANK

Draining Into Chemical Tank

1. Through access door in paneling below wash basin (fig. 3), open drain valve which will allow water in waste tank to drain through line (14, fig. 2) into chemical tank.

2. Close valve after draining.

DRAINING OF ENTIRE LAVATORY SYSTEM

System can be drained to prevent freezing or for other reasons as follows:

NOTE: Key numbers in text refer to figure 2.

1. Place vehicle over proper drain catching facilities to comply with local health regulations.

2. Drain chemical waste tank by pulling up on drain plug handle (15) accessible within lavatory compartment at front of stool. Leave handle in raised position.

3. Through access door below wash basin, open basin waste tank drain valve (9) allowing tank

to drain into and out of chemical waste tank. Leave valve open.

4. Drain wash basin water supply tank through water faucet.

NOTE: Leave all drain cocks open until system is to be refilled.

VENTILATING BLOWER AND MOTOR

Ventilator blower and motor is mounted at right side of service compartment and is accessible after opening the small door on riser panel at right side of wash basin (fig. 3).

Blower motor brushes or the motor circuit fuse can be replaced without having to remove unit from mounting.

Blower and Motor Removal

1. Open service compartment door on riser panel at right side of wash basin.

2. Disconnect wiring at fuse holder connector and tape connection.

3. Loosen clamp attaching large flexible air inlet hose to blower shroud.

4. Loosen clamp at blower shroud air outlet to engine air intake hose and remove hose from blower shroud.

5. Remove two bolts which attach blower assembly mounting clamp to mounting bracket, then remove motor with fan and housing assembly.

Blower Motor Installation

1. Place blower motor with fan and housing in position, then attach to mounting bracket with clamp.

2. Install large flexible air inlet hose to blower shroud and attach with clamp.

3. Install flexible air outlet hose to blower shroud and attach with clamp.

4. Connect electrical wiring. IMPORTANT: Tape wiring connections securely.

5. Check motor operation.

Disassembly and Assembly

Procedures for disassembling and assembling blower and motor assembly are the same as previously covered in "LAVATORY" (SEC. 3) in Maintenance Manual X-6114.

WASH BASIN SUPPLY LINE CHECK VALVE

Check valve is installed in top of wash basin water supply tank mounted behind lavatory compartment rear upper closure panel.

Valve is a ball type and opens when water is drawn from the faucet to maintain pressure within the tank.

The valve should be periodically cleaned and inspected as follows:

Removal

1. Rotate screws to disengage fasteners at lavatory rear panel.

2. Open rear section of side window in lavatory compartment and slide panel toward side window and front of coach far enough to reach mirror light, ventilating motor and door buzzer wiring harness over top of panel.

3. Disconnect wiring harness connectors, then remove panel.

4. Remove check valve and elbow assembly from top of water supply tank.

5. Use two 1-1/8 inch open-end wrenches to separate valve body and cap assembly.

6. Examine check ball, spring and disc for pitted or damaged condition. Replace check ball if necessary.

Installation

1. Clean out check valve body, cap and elbow, then install check ball, spring and seat in body.

2. With valve stamped 225595, place five copper washers between valve body and cap. With valve stamped 279337, place one washer between body and cap. Thread valve body into cap and tighten.

3. Place a suitable sealer on threads of valve stem and reinstall in top of water supply tank. Tighten firmly.

NOTE: When reinstalling valve, make sure arrow on side of valve is pointing toward tank elbow.

4. Place rear panel in position, install wiring harness to top of panel; then rotate screws to engage panel fasteners.

WASH BASIN WATER FAUCET

The gravity feed wash basin water faucet, shown in figure 1, may be removed for cleaning or repair as explained below:

Removal

Key numbers in text refer to figure 6.

1. Open water faucet to completely drain wash basin supply tank.

2. Open service compartment access door (fig. 1) to gain access to water faucet fittings.

3. Remove union ring (19), then disconnect water supply line from water faucet.

4. Remove mounting nut (18), shank washer (17), and adapter (16) which attach the faucet assembly to the wash basin trim panel.

Installation

Key numbers in text refer to figure 6.

1. Place faucet assembly through opening in wash basin trim panel and position as shown in figure 1.

2. Place adapter (16) over threads of faucet.

3. Place shank washer (17) over faucet mounting threads and position against wash basin trim panel, then install mounting nut (18); tighten firmly.

4. Place water supply line through union ring (19) and seat into body of faucet. Tighten union ring firmly.

LAVATORY

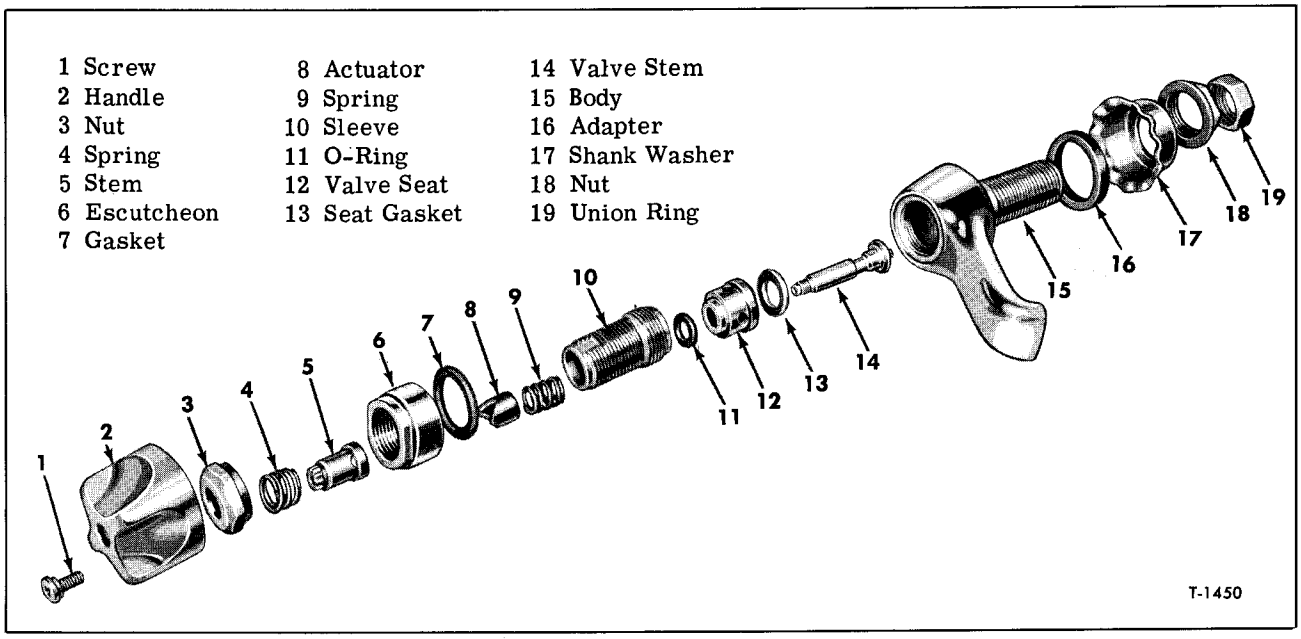


Figure 6—Water Faucet Components

Disassembly

Key numbers in text refer to figure 6.

1. Remove screw (1), then remove handle (2) from stem (5).
2. Remove nut (3) from escutcheon (6), then remove stem (5) and spring (4).
3. Remove escutcheon (6) from sleeve (10).
4. Remove sleeve (10) from body (15), then hold valve stem stationary and remove actuator (8) and spring (9).
5. Press valve stem from sleeve (10).
6. Examine O-ring and gaskets for worn or damaged condition. Clean all threaded areas thoroughly. Replace valve stem and seat if excessively pitted.

Assembly

Key numbers in text refer to figure 6.

1. Place O-ring (11) against seat of sleeve (10).
2. Position lip of valve seat (12) against O-ring (11) in sleeve (10), then place gasket (13) against seat (12).
3. Press valve stem (14) into sleeve (10) until tight against gasket (13), then install spring (9) over valve stem.
4. Hold valve stem and install actuator (8) on valve stem. Tighten firmly.
5. Thread sleeve (10) into faucet body (15) and tighten firmly.
6. Place gasket (7) over sleeve (10), then install escutcheon (6) and tighten firmly.
7. Place spring (4) over stem (5), then install against actuator (8). Install nut (3) and tighten firmly.
8. Install handle (2) and secure to valve stem with screw (1).

EMERGENCY BUZZER

Information on emergency buzzer in "LAVATORY" (SEC. 3) in Maintenance Manual X-6114, is still applicable except refer to "Wiring Diagram - MD93902" in back of this manual for circuit continuity.

SPECIFICATIONS

WATER SUPPLY TANK
- Capacity ..... 13.5 gal.

WASH BASIN DRAIN TANK
- Capacity ..... 13.1 gal.

CHEMICAL WASTE TANK
- Total Capacity ..... 10.5 gal.
- Water Required After Cleaning ... 1.5 gal.

VENTILATING BLOWER MOTOR
- GM Part Number 2361146

VENTILATING BLOWER MOTOR (Cont'd.)
- Make ..... Universal Electric
- Model 4-107-9
- Type ..... Series wound
- Volts ..... 12 DC
- Amperes 3
- Rotation (Shaft End) ..... Clockwise
- RPM 3000

PASSENGER EMERGENCY SIGNAL BUZZER
- Make ..... Delco-Remy
- GM Part Number 1116882

DD3 Brake Actuator System

DESCRIPTION

The DD3 brake actuator system consists of three major units connected by air lines. These are, the brake actuator (chamber), a push-pull control valve (for manual parking and emergency application), and an inversion valve (to direct the flow of air pressure to either parking or locking chambers). Of these three units the actuator is used by either the service or parking systems, while the other units are used wholly by the parking system to operate the foundation brake. These three units are used in conjunction with a standard foot control valve and a slack adjuster connection to standard cam-operated wheel brakes.

For service information on other components of the vehicle brake system refer to Maintenance Manual X-6114, under BRAKES (SEC. 4). Information covering the general air brake system, the air compressor, various control valves, brake shoes and linings, slack adjusters, etc., is contained in the reference manual.

Since this DD3 system serves both parking and service brake systems, information on mechanical parking brake in Maintenance Manual X-6114 applies only to those vehicles which have both DD3 parking brake and mechanical parking brake.

The name of the system is derived from the description of the actuator (chamber). "DD" describes the double diaphragm and the suffix "3" denotes the triple action for service, parking and emergency braking. The actuator functions normally as a service brake chamber but in addition has a means of mechanically locking a brake application so it can be used for parking. The DD3 brake actuator is used only at the rear wheels. Standard air-operated chambers are used at the front wheels.

SERVICE BRAKE OPERATION

Figure 1 shows schematically how the system works. With the handle of the push-pull control valve pushed in, air pressure from the parking reservoir is delivered through the push-pull control valve to the control port of the inversion valve. From there it is routed to the lock port of the DD3 brake actuator. Air pressure, acting on the actuator piston moves it forward to contact the rollers which roll up the ramp of the piston holding them away from the push plate shaft. This allows the push plate and shaft to move freely in both directions for normal service brake application and release.

PARKING OPERATION

To park, the handle of the push-pull control valve is pulled out. This action closes the inlet valve, closing off any further air supply to the push-pull valve control port (and from there through the inversion valve to the DD3 brake actuator lock port). At the same time, this "pulling out" action opens the exhaust valve of the push-pull control valve, which allows the lock port of the DD3 brake actuator to vent through the control port of the inversion valve and then through the push-pull control valve and the open exhaust port of the foot control valve.

When the DD3 brake actuator lock port is vented the roller spring forces the rollers against the ramp on the collar to engage them with the push plate shaft.

When the control port of the inversion valve is vented, the inversion valve piston moves forward and opens the inlet-exhaust valve. This opens the line from the parking reservoir and allows air pressure to flow into the parking port of the DD3 brake actuator. Full parking reservoir pressure is delivered and a parking brake application results. With the rollers against the shaft, the shaft can move forward but is locked so that it cannot return for release. To release parking brake application it is necessary to have full pressure in the air system, "push in" on push-pull control valve (make sure it stays "in") and make a full 100 psi service brake application.

EMERGENCY OPERATION

The vehicle is equipped with an air pressure gauge (in the instrument cluster) and a low air pressure buzzer. When the operator is aware of a loss of air pressure as indicated by the gauge or the buzzer, and the service brakes will not stop the coach, a manual emergency application of the parking brake should be made by pulling out the handle of the push-pull control valve. Brakes then operate as described under the heading of "Parking Operation."

In the event the operator does not respond to the warning system or if the system fails to function, or if the loss of air pressure is too sudden for action, and if the air pressure in the parking reservoir falls below 40 psi, the push-pull control valve will automatically "pop" out, causing pressure in the DD3 actuator lock port to exhaust, which will result in an automatic parking (emergency) brake application.

AIR BRAKES

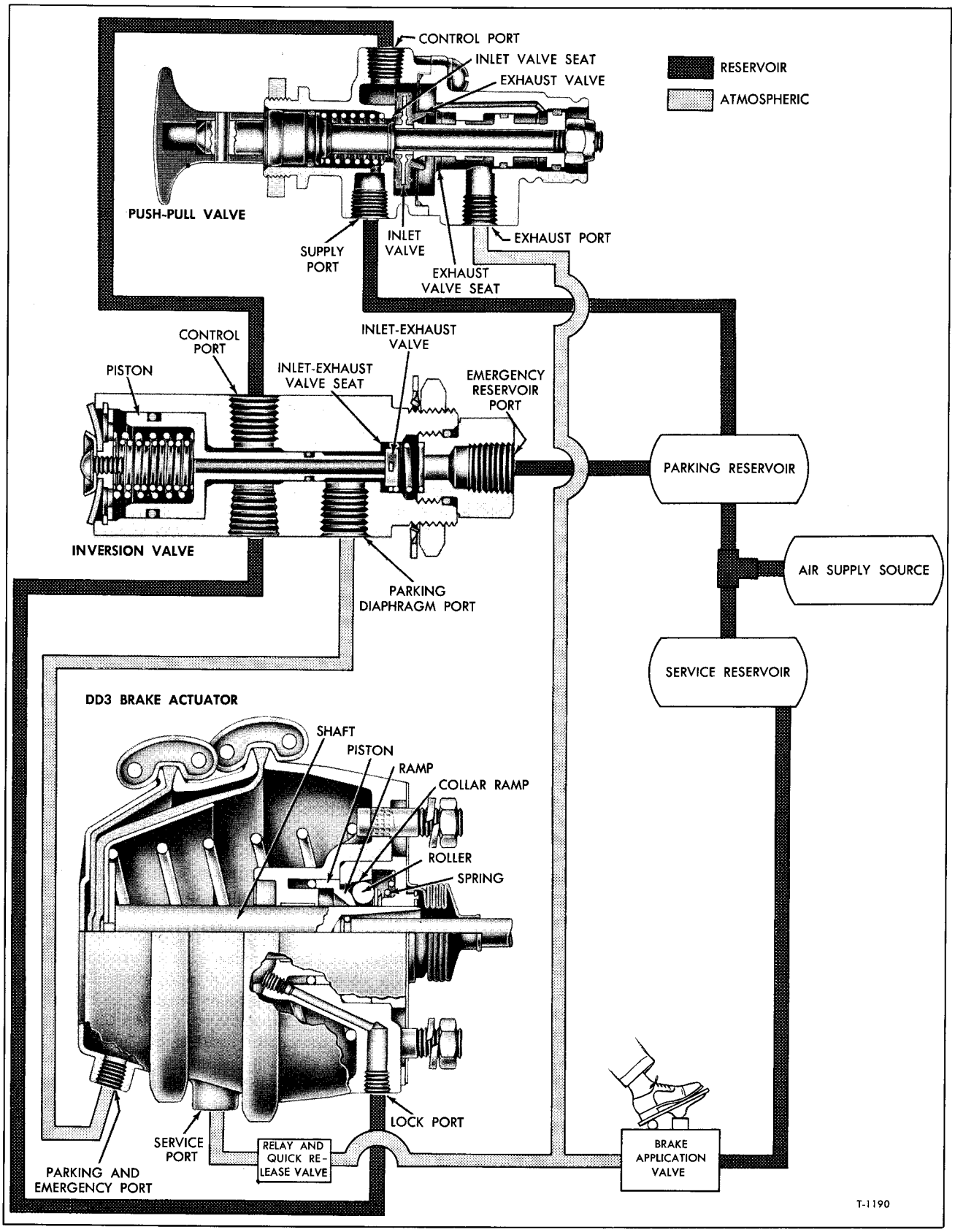


Figure 1—Schematic Diagram of DD3 Brake Actuator System

DD3 BRAKE ACTUATOR

OPERATION

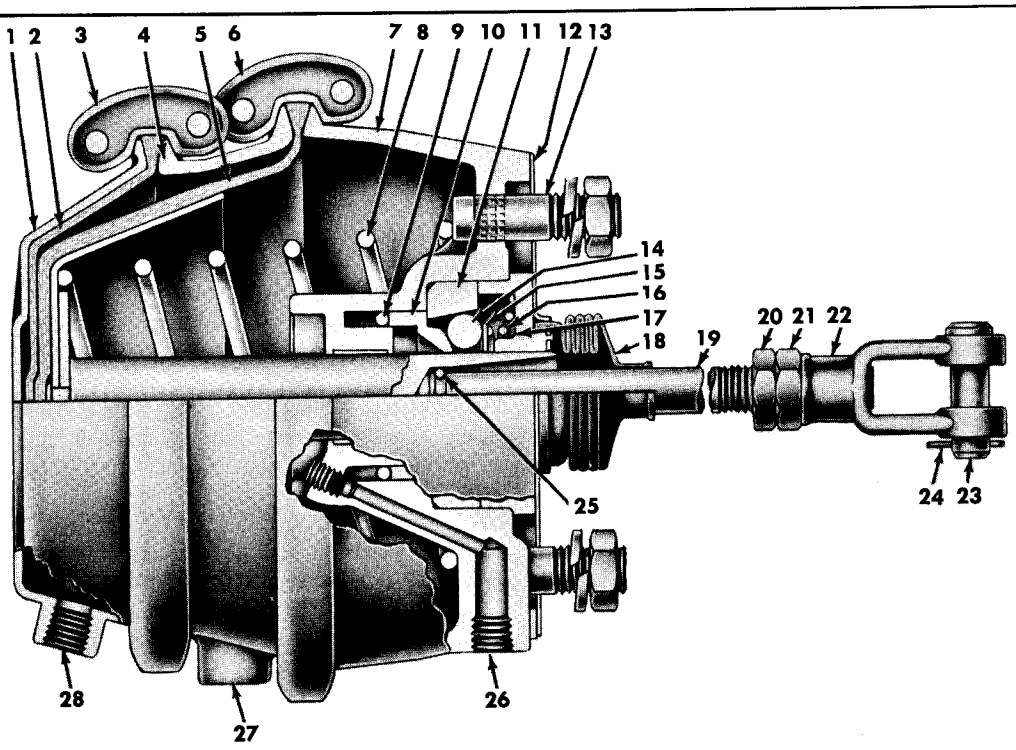
NORMAL RUNNING

Through the push-pull control valve and an inversion valve, air enters the actuator locking port and exerts pressure on the locking piston. The resultant force moves the locking piston forward against the rollers and roller spring. The beveled, or ramp, end of the piston will pick up and hold the rollers away from the shaft. As long as air pressure remains against the locking piston and the rollers are not in contact with the shaft, normal service brake applications will permit the shaft to move freely, back and forth, past the locking mechanism. When a normal service brake application is made, air enters the actuator service port and applies pressure against the service diaphragm. The diaphragm moves the push plate and shaft out, applying the brakes. Upon the release of the service application, the brakes are released.

PARKING

To park, air is exhausted from the locking port and air is applied against the parking diaphragm through the parking diaphragm port. When air is exhausted from the lock piston, the roller spring forces the rollers against the collar and shaft. Air entering the parking port exerts force on the parking diaphragm. The diaphragm moves the push plate and shaft out, applying the brakes. With no air on the lock piston, the shaft becomes mechanically locked in the applied position as the rollers wedge between the shaft and collar.

NOTE: While in a parked position, when there



1 Auxiliary Pressure Plate
2 Auxiliary Diaphragm
3 Auxiliary Clamp Ring
4 Service Pressure Plate
5 Service Diaphragm
6 Service Clamp Ring
7 Non-Pressure Plate
8 Return Spring
9 Piston Grommet
10 Piston
11 Collar
12 Splash Guard
13 Mounting Bolt
14 Roller
15 Spring Seat Washer
16 Roller Spring
17 Lock Cap
18 Boot
19 Push Rod
20 Lock Nut
21 Adjusting Nut
22 Clevis
23 Clevis Pin
24 Cotter Pin
25 Retainer Ring
26 Lock Port
27 Service Port
28 Parking and Emergency Port

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Figure 2—DD3 Brake Actuator Assembly

is a loss of air pressure on the parking diaphragm, the output force on the shaft is reduced. However, the shaft will not retract since its output force is transferred to the mechanical lock mechanism.

RELEASE OF PARKING APPLICATION

To release a parking application of the DD3 brake actuator, it is necessary to re-apply air pressure to equal a shaft force approximately the same as was used in making the parking application. This is necessary to release the locking rollers so they can be moved away from the shaft when air is re-applied to the locking piston. This can be accomplished by making a 100 psi service application after the push-pull control valve is "in" to release the parking application.

To release a parking application, air enters the locking piston and the air on the parking diaphragm is exhausted. A full 100 psi service brake application will be necessary to force the shaft forward sufficiently to allow the locking rollers to disengage and unlock the shaft. Upon release of the service application, the return spring will return the shaft to the release position.

In the event of a loss of air from the service system and it becomes necessary to move the vehicle before service air can be restored the brakes may be manually released as follows:

IMPORTANT: BLOCK WHEELS OF VEHICLE BEFORE RELEASING BRAKES.

Exhaust any air pressure remaining in the parking reservoir by opening drain cock, then back off the slack adjuster at each rear brake chamber. If necessary, disconnect slack adjuster from chamber push rod clevis.

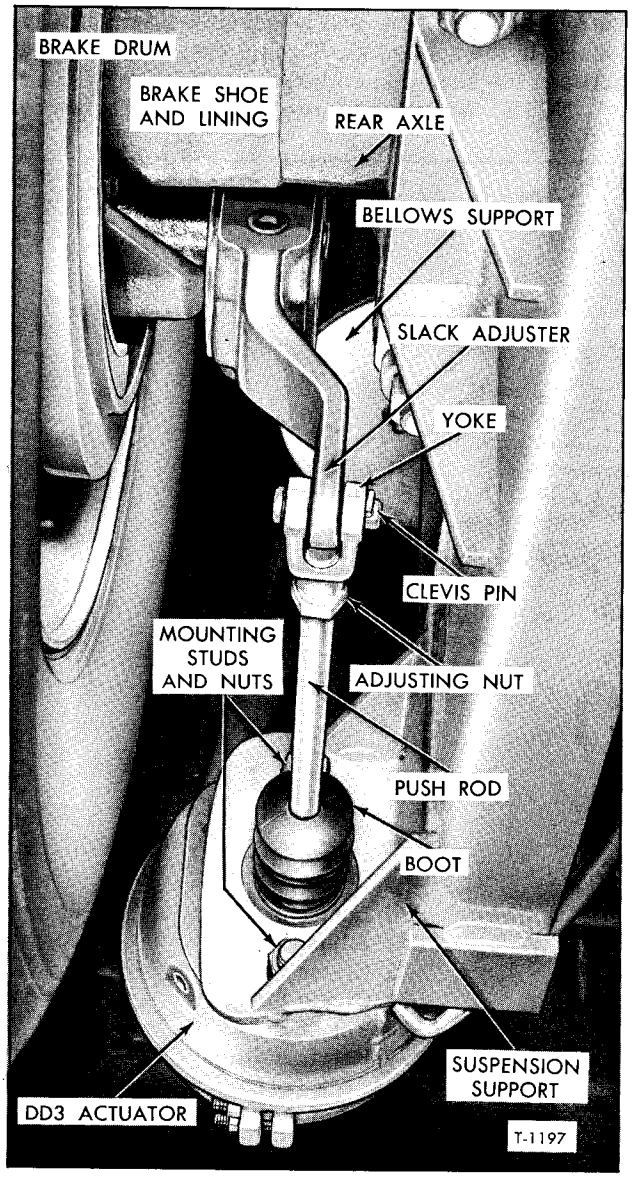


Figure 3—DD3 Brake Actuator Installed

PREVENTIVE MAINTENANCE

Depending on experience and type of operation, the drain slot in the actuator non-pressure plate should be checked and cleared periodically.

Brakes should be adjusted as is customary with any brake chambers. Push rod travel should be as short as possible without brakes dragging. Excessive travel not only shortens the normal service life of diaphragms but gives slow braking response, wastes air, and decreases brake torque output.

Push rod to slack adjuster alignment should be checked in both the applied and released positions, the rod should move out and return properly without binding. Also, check the angle formed by the slack adjuster arm and push rod. It should be 90° or greater in any position, after adjustment.

AT BRAKE RELINE (OR AT LEAST ONCE A YEAR)

Inspect DD3 brake actuator diaphragm and replace if necessary. Disassemble DD3 brake actuator, clean all parts and lubricate locking mechanism. A special barium base grease (or its equivalent) is recommended as a lubricant. This grease is available from the GMC Parts Warehouse.

When diaphragms or return spring or both are replaced, like parts in the corresponding brake actuator on the same axle should also be replaced.

OPERATING AND LEAKAGE CHECKS

OPERATING

With the brake actuator in the released position, make several service brake applications and note that actuators apply and release properly. Operate parking push-pull control valve and observe that actuators apply. While actuators are in a parking position, drain air supply to parking diaphragm and note that actuators remain applied.

Replenish air supply to auxiliary diaphragm. Operate push-pull control valve to release parking application, then make a 100 psi service application to complete release of actuators. The magnitude of the service brake application to release the brakes may vary on different vehicles due to compressor governor settings. A service application of approximately 100 psi will release the brakes.

LEAKAGE

With air system at maximum governor pressure and DD3 brake actuators in the released position, check drain slot and around the push rod boot with a soapy solution to detect possible leakage by the locking piston grommet.

Make and hold a service brake application and again check the actuator drain slot for service diaphragm leakage. Continue to hold the service application and coat around the service and parking diaphragm clamping rings with the soapy solution to detect seal leakage.

Operate the actuator control valve to a parking position and check the exhaust port of a service brake application to detect parking diaphragm leakage. This parking diaphragm leakage detection point could be the exhaust port of the foot brake valve, quick release valve or relay valve. While still in a parking position, the parking diaphragm clamping ring should be coated with the soap solution to detect seal leakage.

Should leakage be detected at the clamping rings in either of the above tests, the clamping ring nuts should be tightened evenly but only enough to stop leakage.

If the DD3 brake actuator does not function as described, or leakage is excessive, it is recommended that it be repaired or replaced.

REPLACEMENT

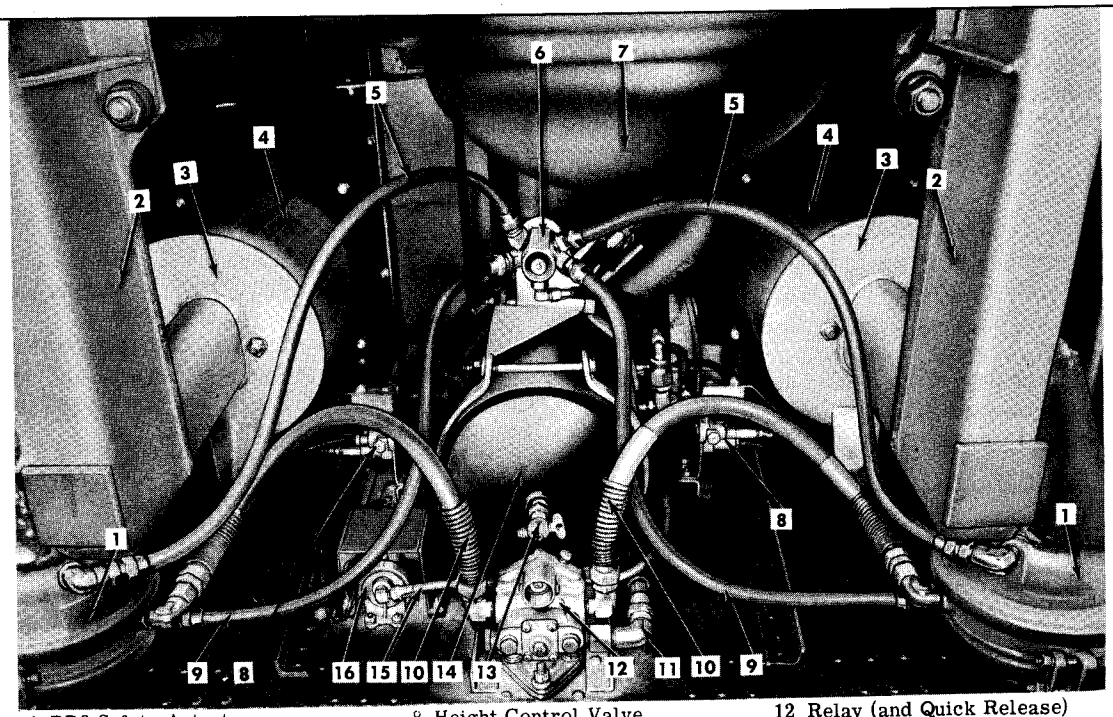
(Refer to Figures 3 and 4)

REMOVAL

1. Block and hold vehicle by some means other than air brakes.

2. With the brake actuators in the released position, disconnect or completely remove air brake hoses from parking and service ports of the actuator.

3. At this point, exhaust air from parking reservoir. This may be done by opening the drain cock in the reservoir tank or by pulling out the push-pull control valve button.



1 DD3 Safety Actuator
2 Suspension Support
3 Bellows Support
4 Bellows
5 Air Line to DD3 Lock Port
6 Inversion Valve
7 Rear Axle
8 Height Control Valve
9 Air Line to DD3 Parking and Emergency Port
10 Air Line to DD3 Service Port
11 Air Supply Line to Relay Valve
12 Relay (and Quick Release) Valve
13 Drain Valve
14 Emergency and Parking Air Tank
15 Air Line to Stop Light Switch
16 Stop Light Switch T-1198

Figure 4—DD3 Brake Actuator System at Rear Axle—Installed

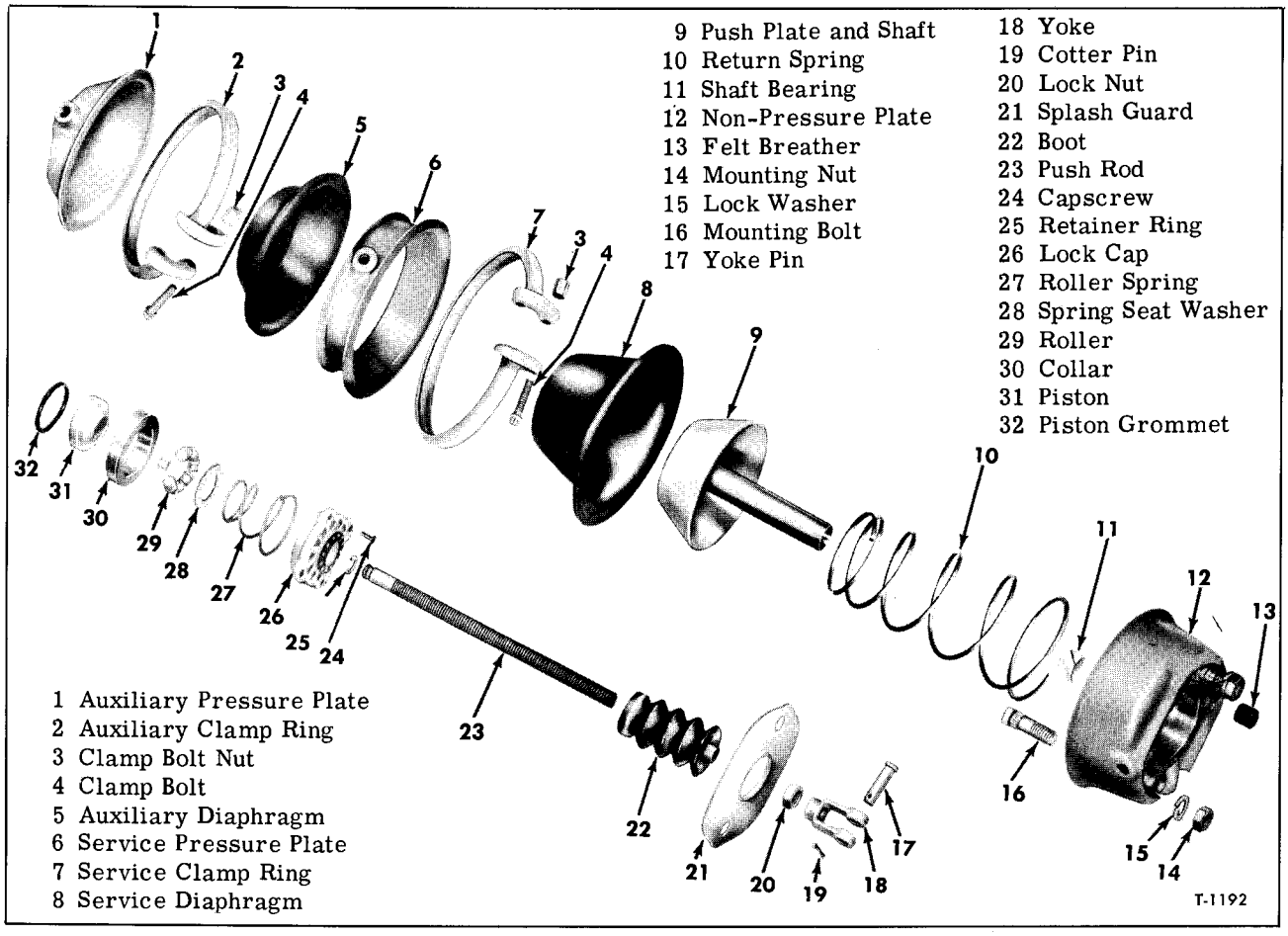


Figure 5—DD3 Brake Actuator Assembly Components

> NOTE OF CAUTION: Air will be exhausted out the line that was connected to the parking port, if the push-pull control valve is operated. If this line is not removed, it should be disconnected in such a way that it will not whip and cause damage as the air exhausts.

4. As a safety precaution, the service system should also be drained.

5. Disconnect air brake hose at actuator lock port.

6. Remove yoke pin cotter pin and knock out yoke pin.

7. Remove mounting nuts, then actuator.

INSTALLATION

IMPORTANT: DD3 brake actuators must be installed with the drain slot pointing down and towards the center line of the vehicle.

1. Mount actuator to mounting bracket and tighten securely.

2. Fasten actuator push rod yoke to slack adjuster with yoke pin. Lock yoke pin with cotter pin. The angle formed by the push rod and slack adjuster arm should be greater than 90°.

3. Connect air brake hoses to actuator. Taking precautions that the proper hose is installed in the correct port, and hoses are positioned for proper movement during coach operation.

4. Adjust brakes.

5. Build up air pressure in system and test operation of brakes.

6. Test for leaks.

DISASSEMBLY

(Refer to Figure 5)

1. Clean brake actuator exterior of all road grime. Mark it in such a way that it can be reassembled correctly.

2. Remove yoke and yoke lock nuts.

3. Remove boot, splash guard and felt breather.

4. Remove auxiliary and service clamping ring nuts and bolts. Spread clamping rings slightly, just enough to slip them off the plates. It may be necessary to use a soft mallet driver to break the clamping rings loose. If the rings are being reused,

caution should be taken against bending them out of shape.

5. After clamping rings are removed, auxiliary pressure plate, parking diaphragm, service pressure plate and service diaphragm are removed in that order.

6. Place the remains of actuator on a smooth surface with the push plate down. Connect an air supply (shop air) line to the locking port. By hand press down on the actuator non-pressure plate and at the same time apply air to the locking port. As the shaft is unlocked, ease the non-pressure plate back and remove push plate and shaft assembly with push rod and return spring.

7. Hold lock cap down against roller spring tension and completely remove all four (4) cap screws before releasing and removing cap.

8. Remove roller spring and spring seat washer.

9. Remove all eight (8) rollers.

10. Next cautiously apply air at the locking port to assist in removal of collar and piston, and to remove piston grommet.

11. Inspect bearing in shaft bore of non-pressure plate and remove it only if it is showing signs of wear and is to be replaced.

12. The push rod should not be removed from the shaft unless it is damaged. If the rod is removed it must be replaced. To remove the rod, place a heavy washer over the rod against the shaft, then position a spacer and second washer over the rod and beneath the yoke lock nut(s). Turn the lock nut(s) down with a long handled wrench, pulling the push rod from the shaft.

13. The knurled T-bolts in the non-pressure plate can be removed and replaced if damaged.

CLEANING AND INSPECTION

Wash all metal parts in a good cleaning solvent. Dry thoroughly. Any reuseable rubber parts should be wiped clean. Discard felt breather. Inspect all parts for excessive wear or deterioration. Particular attention should be given to the piston and collar bores in the plate. Also, the air passage from the lock port to piston bore should be clean and not restricted. It may be necessary to remove the inspection plug to thoroughly clean this passage.

Rollers should be checked carefully and all replaced if one or more need replacing. Check springs for cracks, distortion or corrosion.

Replace all parts not considered serviceable during these inspections, especially rubber parts.

ASSEMBLY

1. On assembly, line up parts as they were marked prior to disassembly.

2. If the bearing in the non-pressure plate was removed it should be reinstalled or replaced.

3. Lubricate piston and collar bores, shaft, piston grommet, piston and roller cavity with a barium base grease (or equivalent).

4. Position piston grommet in piston bore. Then piston, with smooth end down, against grommet.

5. Place collar in its bore in plate.

6. Position all eight (8) rollers in groove formed by top of piston and collar ramp.

7. Place roller spring seat washer on top of rollers.

8. Position cone shaped roller spring on washer with small end to washer.

9. Position cap on roller spring. Press cap down and hold while installing cap screws evenly and securely.

10. Turn over non-pressure plate with lock mechanism installed and position return spring in plate with large end down.

11. Position push plate and shaft over return spring and press down so shaft moves through lock. The lock should hold shaft position against return spring. If not, check assembly to this point.

12. Install service diaphragm, service pressure plate and clamping ring.

13. Install auxiliary diaphragm, auxiliary pressure plate and clamping ring.

14. Tighten clamping ring bolts in both clamping rings evenly and securely.

15. Install boot and new breather felt, then splash guard down over boot.

16. Perform checks as outlined in "Operating and Leakage Checks."

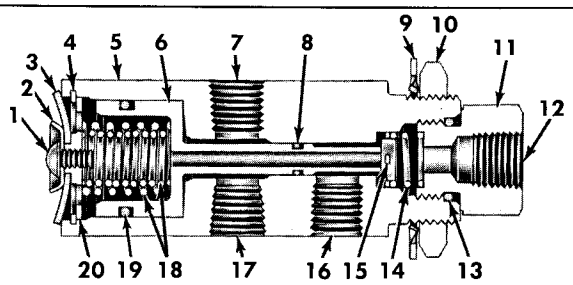
INVERSION VALVE

DESCRIPTION

(Refer to Figure 6)

The inversion valve is used in combination with the DD3 brake actuators and push-pull control valve in a parking and/or emergency system. When the push-pull control valve is operated, the inversion valve operates permitting air in the parking reservoir to apply the brakes. The inversion valve also operates automatically when air pressure drops to a predetermined pressure (40 psi).

The inversion valve employs a 1-1/4" diameter hole mounting. The valve serves as a manifold having a total of six (6) 1/4" pipe ports; three (3) control ports, two (2) delivery ports and one (1) supply port. These ports are identified. The control ports are marked "C," supply "S" and the delivery ports are marked "D." The exhaust port is protected by a diaphragm.



1 Cap Screw
2 Diaphragm Washer
3 Exhaust Diaphragm
4 Retainer Ring
5 Valve Body
6 Piston
7 Control Port
8 Piston Grommet (Small)
9 Lock Washer
10 Mounting Nut
11 Cap Nut
12 Supply Port
13 Seal Ring
14 Inlet and Exhaust Valve Spring
15 Inlet and Exhaust Valve
16 Delivery Port
17 Control Port
18 Piston Springs
19 Piston Grommet (Large)
20 Cover Plate T-1193

Figure 6—Inversion Valve Assembly

OPERATION

With no air pressure in the system, the inversion valve inlet valve is open and its exhaust is closed. On initial build-up, as air enters the parking reservoir to which the inversion valve supply port is connected, it will pass by the open inlet and out the delivery ports. When system air pressure reaches between 50 and 60 psi and the push-pull control valve is pushed in, air will pass into the inversion valve from the push-pull control valve. This air flows in one control port and exerts a force on the inversion valve piston. At a pressure between 60 and 70 psi, the piston moves against the resistance of the two (2) piston springs. The piston exhaust seat moves away from the inlet and exhaust valve, opening the exhaust passage. The inlet valve spring and supply air at the inlet valve will cause it to seat. Air at the inversion valve delivery will now exhaust from the valve exhaust port.

PARKING OR EMERGENCY

The air at the inversion valve control ports is exhausted through the push-pull control valve exhaust when it is operated. The piston springs will then cause the piston to move and seat on the inlet and exhaust valve closing the exhaust passage. The inlet valve is moved off its seat by the piston, so that supply air from the parking reservoir will pass by the open inlet and out the delivery ports.

When the application is released by pushing in on the push-pull control valve, air passes into the inversion valve control port. The piston moves away from the inlet and exhaust valve, opening the exhaust passage through the piston. The inlet valve closes and air in the delivery ports will exhaust through the center of piston stem and out the inversion valve exhaust port.

PREVENTIVE MAINTENANCE

Every year or after 50,000 miles the inversion valve should be disassembled, cleaned and lubricated. Lubricate with a barium base grease (or equivalent).

Rubber parts should be replaced and any other parts which show signs of wear or damage should also be replaced.

OPERATING AND LEAKAGE CHECKS

OPERATING

With the air brake system built up to governor cut out pressure and the brakes released, operate by pulling out the push-pull control valve button to apply the brakes. Note that the brakes apply.

Operate by pushing in the push-pull control valve to release the brake application and note that the delivered air from the inversion valve is exhausted out its exhaust port. The operation of the push-pull control valve will not necessarily complete the release of the brakes. A full 100 psi service brake application after the push-pull control valve is pushed in should complete the release.

LEAKAGE

Start leakage checks with system pressure up to governor cut out and brakes released. Check the inversion valve exhaust port for possible leakage at (1) the large piston grommet; (2) piston stem grommet or; (3) the inlet valve or its seat. Slight leakage is permissible. While the inversion valve is still in this position, the cap nut should be checked for leakage by the seal ring.

Actuate push-pull control valve by pulling out on the button to apply the brakes, then check the inversion valve exhaust port for exhaust valve or seat leakage.

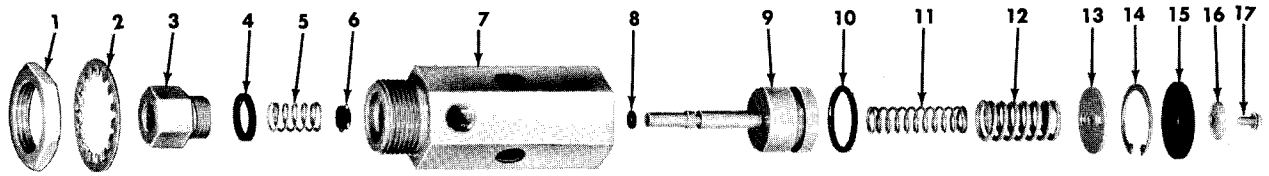
If the inversion valve does not function as described or leakage is excessive, it is recommended that it be repaired or replaced.

REPLACEMENT

(Refer to Figure 4)

REMOVAL

1. Block and hold vehicle by means other than air brakes.
2. Drain service and parking reservoir air supply.
3. Disconnect air lines and air brake hoses from inversion valve.
4. Loosen valve mounting nut and remove valve.



1 Mounting Nut
2 Lock Washer
3 Cap Nut
4 Seal Ring
5 Inlet and Exhaust Valve Spring
6 Inlet and Exhaust Valve
7 Valve Body
8 Piston Grommet (Small)
9 Piston
10 Piston Grommet (Large)
11 Piston Spring (Small)
12 Piston Spring (Large)
13 Cover Plate
14 Retainer Ring
15 Exhaust Diaphragm
16 Diaphragm Washer
17 Capscrew

T-1194

Figure 7—Inversion Valve Assembly Components

INSTALLATION

1. Check and clean air lines to valve.
2. Mount valve securely with mounting nut and lock washer.
3. Connect air lines and air brake hoses.
4. Check for proper operation and leaks.

DISASSEMBLY

(Refer to Figure 7)

1. Remove cap nut with sealing ring, remove sealing ring from cap nut.
2. Turn valve over and remove exhaust check valve diaphragm cap screw with lock washer, then diaphragm washer and diaphragm.
3. With a pair of snap ring pliers, remove retainer ring.
4. Remove cover plate and two (2) piston springs.
5. Remove piston with grommets.
6. Remove piston grommets.

CLEANING AND INSPECTION

Wash all metal parts in a good cleaning solvent. Rubber parts should be wiped clean. Inspect all parts for excessive wear or deterioration. Check springs for cracks, corrosion, or distortion. Inspect piston and its exhaust seat, body bores and inlet valve seat for nicks or burrs. Replace all parts not considered serviceable during these inspections.

ASSEMBLY

Before assembling the valve, lubricate the piston, grommets and body bores with barium base grease (or equivalent).

1. Install piston grommets on piston.
2. Install piston with grommets in valve body.
3. Position piston springs, cover plate and retainer ring in the valve body in that order.
4. Press the cover and retainer down and with a pair of snap ring pliers and snap the ring into the body groove.
5. Install the diaphragm and diaphragm washer and secure with cap screw.
6. Turn inversion valve over and position inlet and exhaust valve in its bore.
7. Place spring down over inlet valve.
8. Install sealing ring on cap nut, install cap nut with sealing ring and tighten securely.
9. Mounting nut and lock washer are installed when valve is mounted on vehicle.
10. Perform "Operating and Leakage Checks" as outlined in this section.

PUSH-PULL CONTROL VALVE

DESCRIPTION

The push-pull control valve is located on a panel to the right of the driver's seat (see fig. 8). For a cross-section view of the valve refer to figure 9. The valve has a black knob which moves in and out ("push-pull") for operation. A red colored ring on the knob, when exposed, indicates that parking brake is on. The valve has four ports; two delivery, one supply and one for connection to the service brake foot control valve. The push-pull valve directs the flow of air to the DD3 brake actuator through the inversion valve. The direction of flow is controlled within the valve by a combination inlet and exhaust valve in conjunction with the position of the knob ("push" for service, - "pull" for parking).

OPERATION

For operation of the push-pull control valve, refer to figure 1 and the description given previously under "Service Brake Operation," "Parking Operation" and "Emergency Operation."

AIR BRAKES

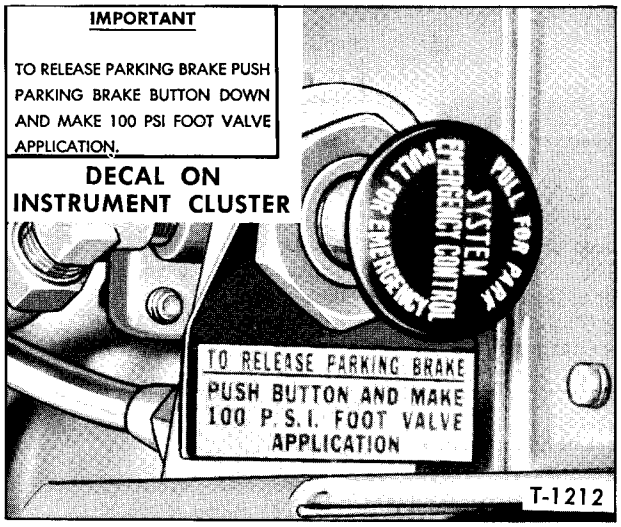


Figure 8—Push-Pull Control Valve Installed

REPLACEMENT

REMOVAL

1. Secure vehicle by some means other than air brakes.
2. Exhaust air from parking brake system. It is unnecessary to exhaust service air.
3. Disconnect air lines from push-pull control valve. Mark lines to assure installation in correct valve ports when replacing valve.
4. Drive spirol pin out of button and remove button.
5. Remove mounting nut from valve body and remove valve from mounting bracket.

INSTALLATION

1. Position valve on mounting bracket and secure with mounting nut.
2. Place button on plunger shaft, line up hole in button with hole in plunger shaft and drive in spirol pin.
3. Connect air lines to push-pull control valve ports making sure lines are connected to correct ports.
4. Build up vehicle air pressure system, and check valve for operation and leaks.

DISASSEMBLY

(Refer to Figure 10)

1. The spirol pin button and mounting nut are removed at the time the valve is removed from the vehicle.
2. Insert a rod or punch in the plunger pin hole to keep plunger from turning while removing nut at bottom of valve.
3. Remove plunger and spring.

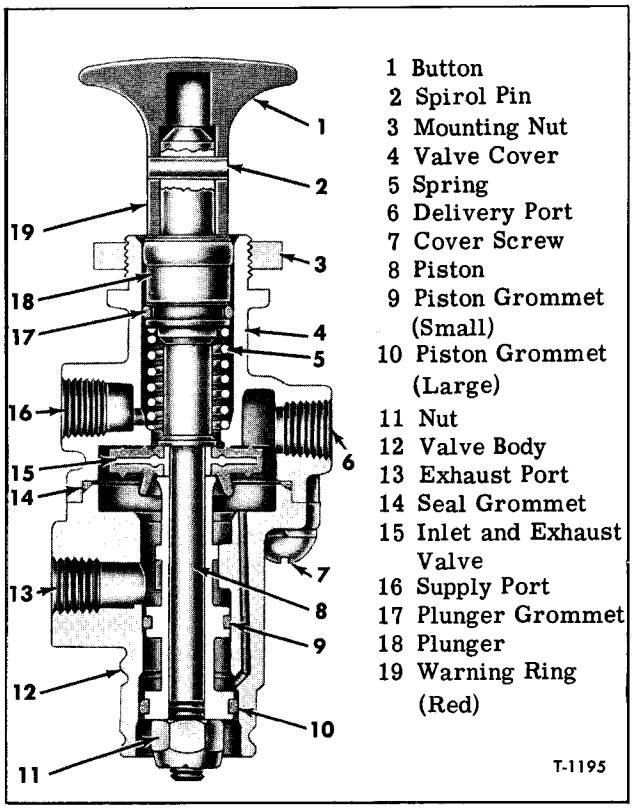


Figure 9—Push-Pull Control Valve Assembly

4. Remove plunger grommet.
5. Remove the two cover screws and separate the cover from the body.
6. Remove the cover seal grommet and the inlet and exhaust valve.
7. Remove the piston.
8. Remove the large (lower) piston grommet, then the small (upper) piston grommet.

CLEANING AND INSPECTION

Wash all metal parts in a good cleaning solvent. Dry thoroughly. Wipe reuseable rubber parts clean. Inspect all parts for excessive wear or deterioration Inspect plunger and piston bores for nicks and burrs. Check springs for cracks, distortion and corrosion. Inspect the inlet and exhaust valve and all grommets for wear or deterioration.

Replace all parts not considered serviceable, especially rubber parts.

ASSEMBLY

Prior to assembly, lubricate all grommets and bearing surfaces of the body and cover with barium base grease (or equivalent).

1. Install grommet on plunger.
2. Place spring on plunger.

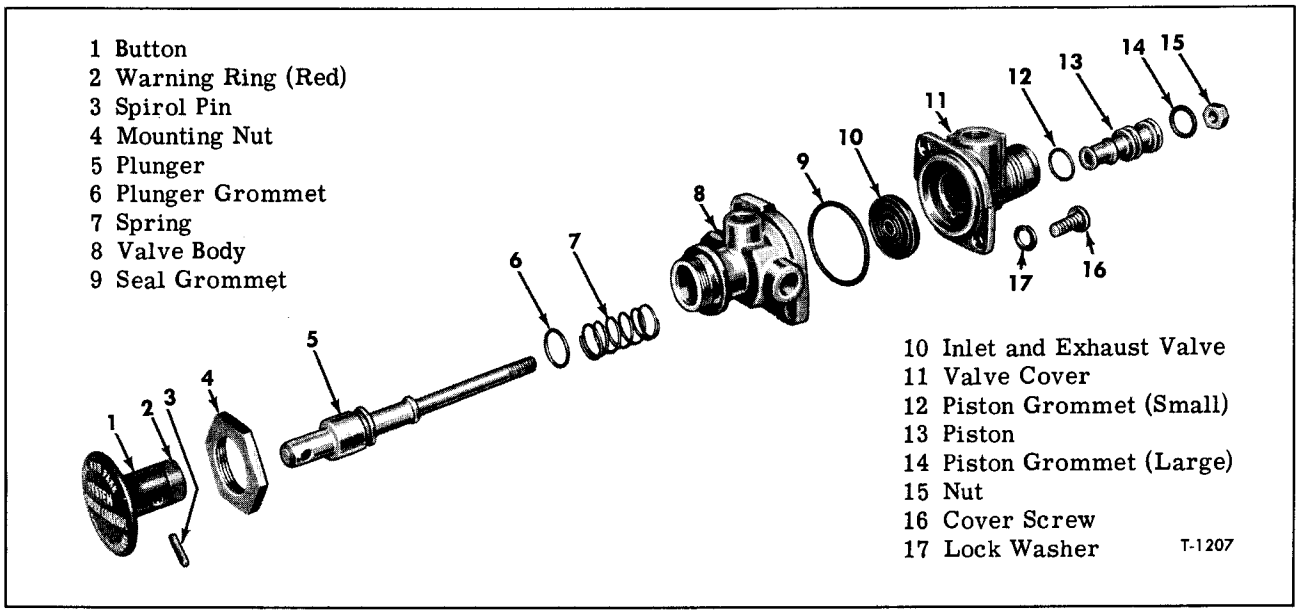


Figure 10—Push-Pull Control Valve Assembly Components

3. Insert plunger, with spring and grommet installed, in body.

4. Install inlet and exhaust valve over protruding end of the plunger. The double beaded side of the inlet and exhaust valve should be up against the body seat.

5. Position cover to body seal grommet in body.

6. Attach cover to body with two screws.

7. Install piston grommets (large grommet in bottom piston groove; small grommet in top piston groove).

8. Install the piston with grommets.

9. Depress the plunger and, with a punch or rod, hold it from turning while installing the plunger stem nut. Torque on the stem nut should be between 30 and 40 inch-pounds.

10. The control button should be installed and held in place by the spirol pin after the valve is mounted.

11. After valve is installed, check for operation and leaks.

Refer to Next Page for "Specifications."

SPECIFICATIONS

BRAKE CHAMBER

Model	DD3
Working Stroke (Approx.)	3″
Ports	
Service	¼″ dryseal thread
Parking	¼″ dryseal thread
Emergency	¼″ dryseal thread
Chamber Length (Approx.)	7 5/32″
Diameter	8⅛″
Spring Force at 0 Stroke	39 lbs. ±5 lbs.
Increase per Inch of Stroke	11½ lbs. ±1½ lbs.

INVERSION VALVE

Model	TR-2
Ports	
Control (3)—stamped "C"	¼″ pipe thread
Delivery (2)—stamped "D"	¼″ pipe thread
Supply (1)—stamped "S"	¼″ pipe thread
Body Size	1½″ Hexagon
Springs	
Inlet and Exhaust Valve Spring	
Free Length	53/64″
No. of Active Coils	4
Load at 33/64″ height	7½ lbs. ±¼ lb.
Piston Spring (Large)	
Free Length	1 11/32″
No. of Active Coils	5½
Load at 53/64″ height	52 lbs. ±2½ lbs.
Piston Spring (Small)	
Free Length	1 47/64″
No. of Active Coils	10
Load at 53/64″ height	10 lbs. ±½ lb.

PUSH-PULL CONTROL VALVE

Model	PP-2
Ports	
Supply (1)	⅛″ dryseal
Brake Valve (1)	⅛″ dryseal
Delivery (2)	⅛″ dryseal
Automatic Release Pressure	40 ±5 psi
Plunger Return Spring	
Free Length	1⅛″
No. of Active Coils	4½
Load at 15/16″ height	3 lbs. ±2 oz.

Clutch and Controls

Information covering clutch release mechanical assist mechanism is included in this section. Mechanical assist mechanism replaces the air-assisted clutch release mechanism used on earlier production coaches.

Also included in this section is information regarding the latest design of clutch and flywheel assembly. In cases where the description and/or procedure relating to the current design differs from that contained in Maintenance Manual X-6114, the difference is covered herein by new text and illustrations.

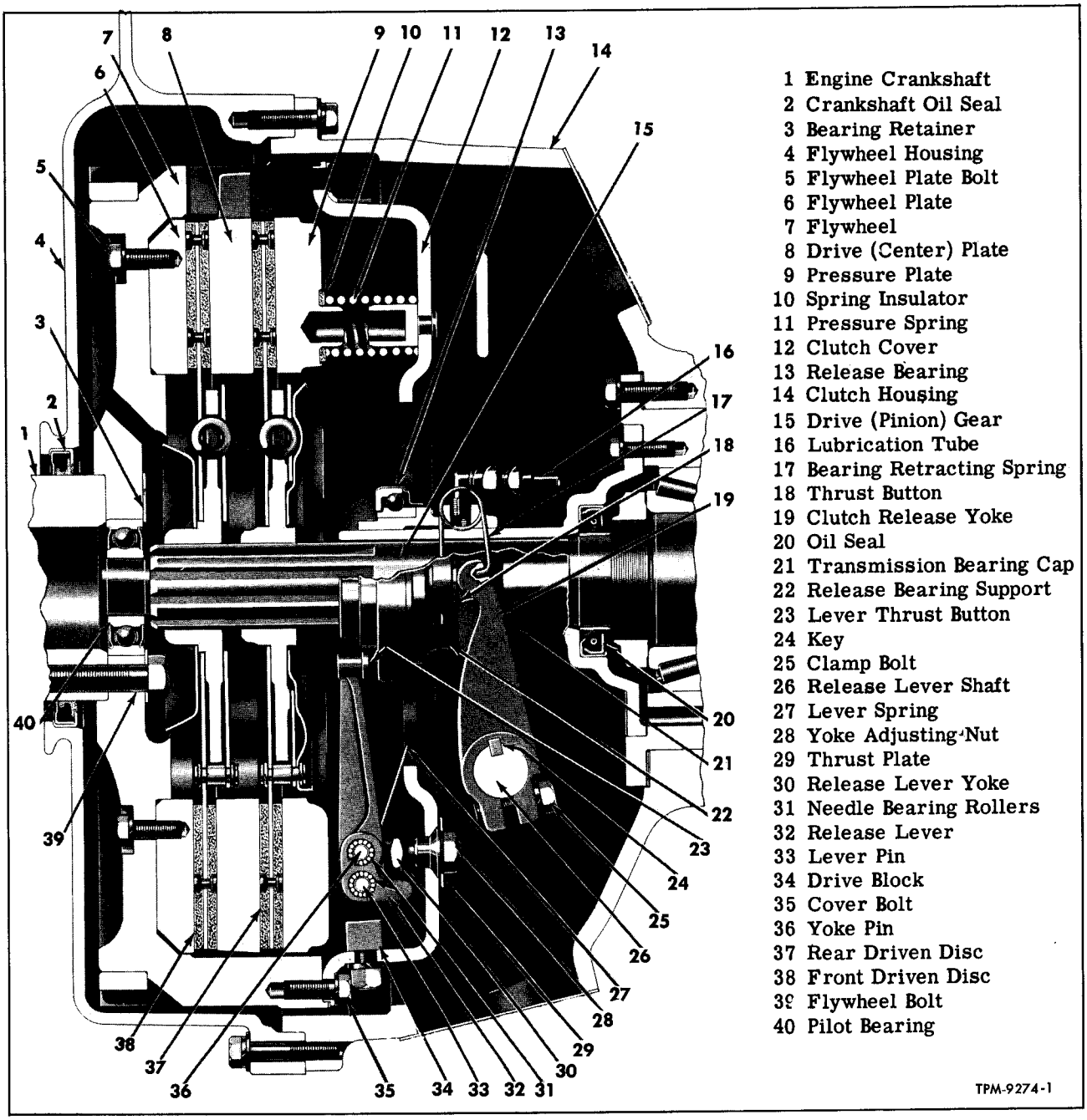


Figure 1—Cross Section of Clutch Installed

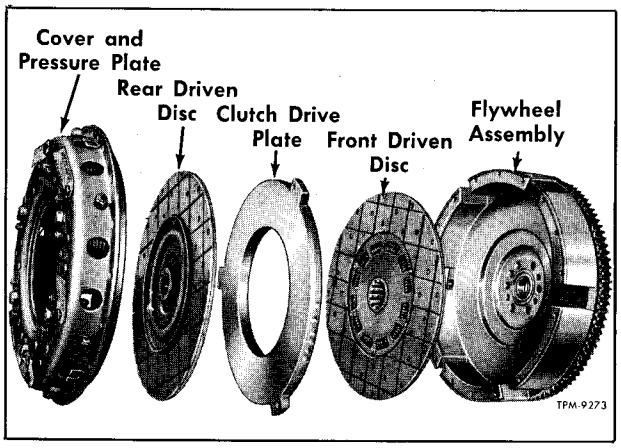


Figure 2—Clutch Components

GENERAL DESCRIPTION

Figure 1 illustrates the clutch installation for current coaches. This differs from earlier production in that the clutch driven discs each have twelve damper springs at the clutch disc hubs, and the oil slingers differ somewhat in design. Slinger on front disc is welded to the disc hub.

Engine flywheels on current coaches have six machined slots with hardened drive faces. If three of the slots, which engage the drive lugs on center drive plate, become worn the drive plate may be installed with lugs engaging the other three unworn slots in flywheel. Figure 2 is a view of clutch components.

Clutch cover and pressure plate assembly remains the same as in the past. A replaceable wear plate (6, fig. 1) is installed in flywheel.

Figure 3 shows the clutch release linkage arrangement. Clutch release is affected by pedal, the movement of which is transmitted to release mechanism through rods and levers.

The mechanical assist mechanism which replaces the former air-assisted release mechanism is described below.

CLUTCH CONTROL ASSIST MECHANISM

Key numbers in text refer to figure 4.

The mechanism shown in figure 4 incorporates an over-center spring arrangement which serves to reduce the effort required to disengage the clutch.

Assist springs (12) are linked to toggle lever (17). Clutch release rod (23) is linked to opposite end of toggle lever (17). Spring (22) holds adjusting handle (2) in contact with release lever (1). Toggle lever (17) is locked to the lever shaft by a set screw, and the toggle lever shaft pivots in needle bearings installed in bracket (11). Pin (18) is also mounted on needle bearing assemblies installed in toggle lever (17). Rod end bearing (4) on assist rod (20) is secured to clevis (3) by bolt (21) which locks the spherical insert to clevis (3). The rod end bearing (4) provides a ball-and-socket

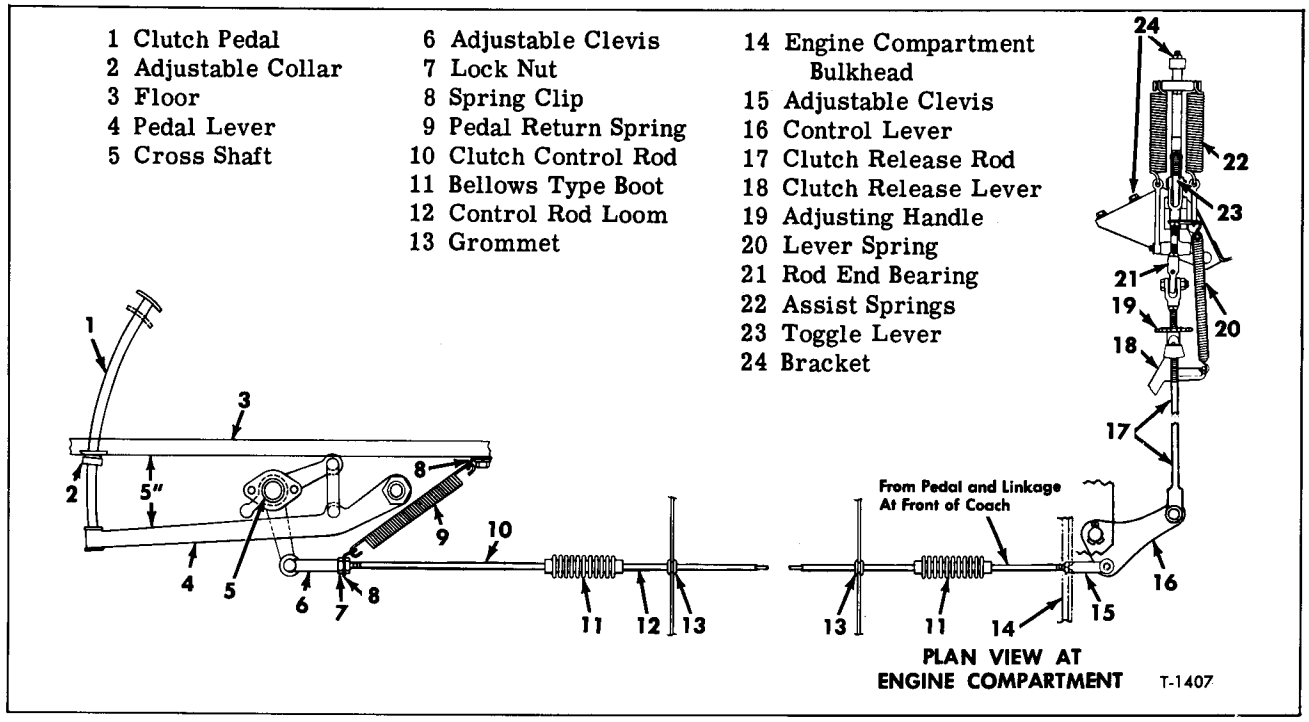
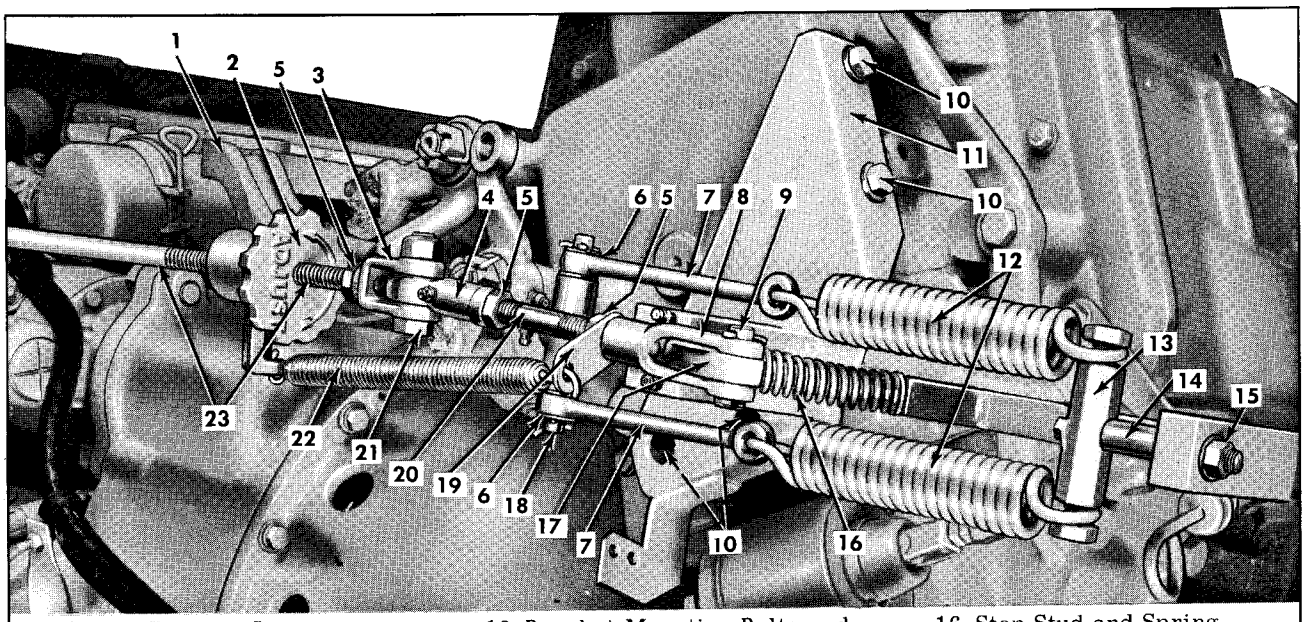


Figure 3—Clutch Control Linkage



1 Clutch Release Lever
2 Adjusting Handle
3 Clevis
4 Rod End Bearing
5 Lock Nut
6 Flat Washers
7 Link
8 Adjustable Clevis
9 Clevis Pin
10 Bracket Mounting Bolts and Washers
11 Bracket (Welded Assembly)
12 Assist Springs
13 Anchor and Bolt Assembly (Welded)
14 Spacer
15 Nut
16 Stop Stud and Spring
17 Toggle Lever Assembly
18 Toggle Lever Pin
19 Spring Clip
20 Assist Rod
21 Clevis Bolt
22 Lever Spring
23 Clutch Release Rod

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Figure 4—Clutch Release Assist Mechanism

type connection between rods (20 and 23) and prevents any binding as the mechanism operates.

Spring (16) on stop stud, cushions toggle lever as it returns to stop stud when clutch is engaged.

When the assist mechanism is properly assembled and installed, no further adjustment should be required. The adjusting handle (2) is provided to allow periodic adjustment to maintain clearance between clutch release bearing and clutch release levers.

Refer to "Clutch Control Adjustments" later in this section for instructions for making release bearing clearance adjustment.

CLUTCH CONTROL MAINTENANCE

CLUTCH PEDAL AND LINKAGE (Fig. 3)

1. Be sure all pivot points in control linkage are lubricated according to instructions given in LUBRICATION (SEC. 13).

2. Check dimension between clutch pedal lever (4) and underside of floor. If necessary to provide the 5-inch dimension as shown, move the adjustable collar (2) which is held in place by set screw.

3. Always use return spring (9) as specified in Parts Book when it becomes necessary to replace the return spring.

CAUTION: Always make adjustments as later described at linkage in engine compartment after replacing any items shown in figure 3.

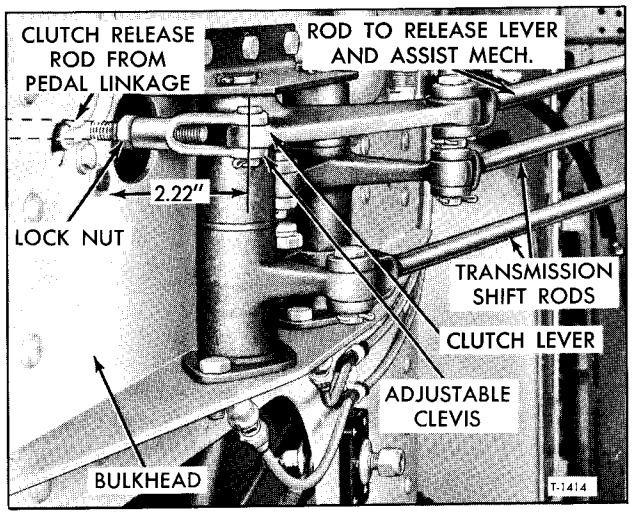


Figure 5—Clutch Bell Crank Lever Position at Bulkhead

CLUTCH AND CONTROLS

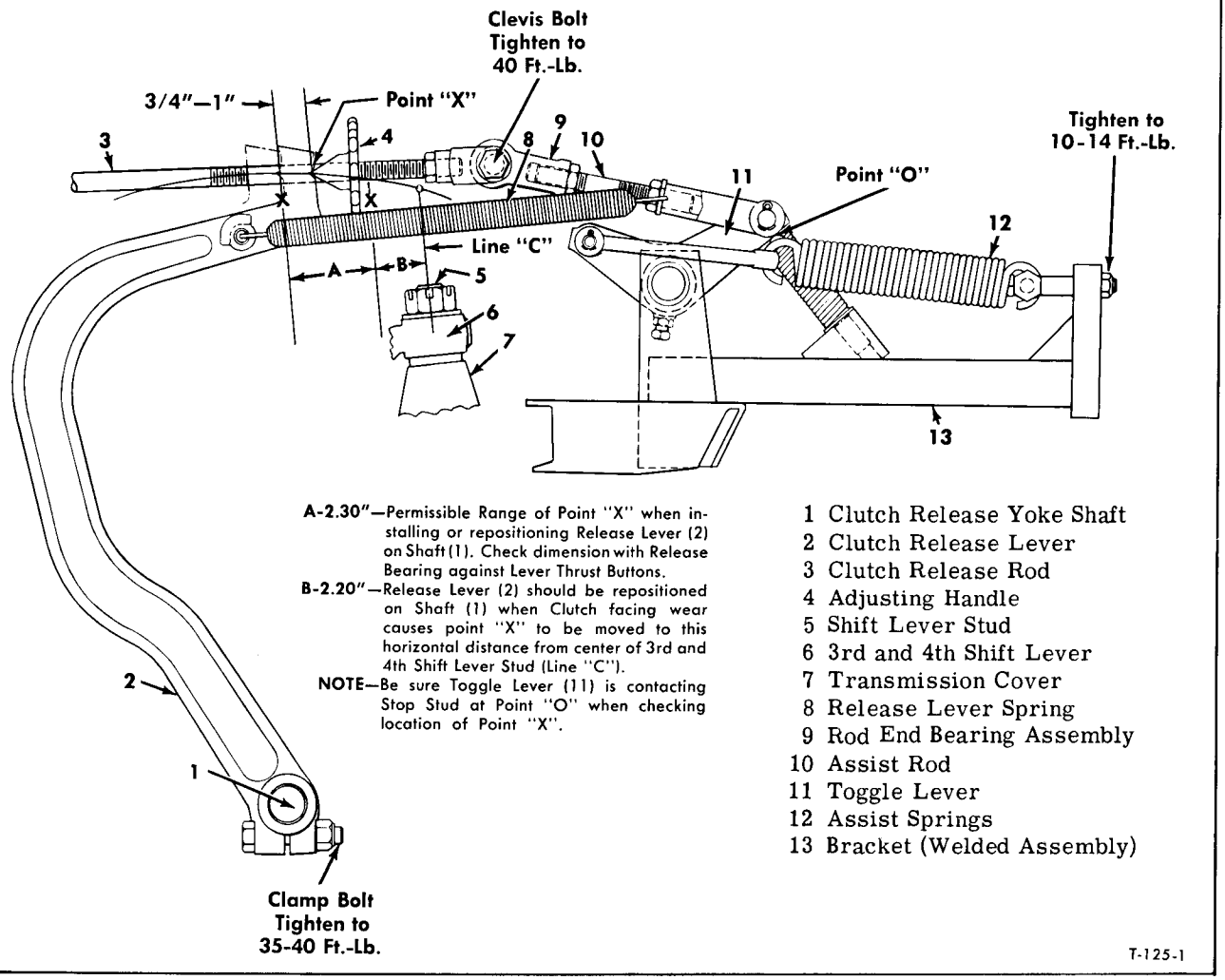


Figure 6—Release Shaft Lever Position and Release Bearing Clearance Adjustment

CONTROL LINKAGE AND UNITS
IN ENGINE COMPARTMENT

The clutch control bell crank and adjustable clevis at rear end of clutch rear control rod are accessible through opening under rear cross seat, inside coach body. Figure 5 shows view of bell crank and rods.

Setting Bell Crank Lever Position

1. Make clutch pedal and linkage adjustment at front of coach as previously directed, making sure the clutch pedal lever is held at the 5-inch dimension as shown in figure 3.

2. Measure distance from center of clevis pin to rear face of bulkhead. Dimension should be 2.22 inches as shown. If necessary, remove clevis pins at bell crank and turn adjustable clevis to properly position the bell crank. After making adjustment, tighten clevis lock nut, then install clevis pins and cotter pins.

NOTE: It may be necessary to remove clevis pin (9, fig. 4) to permit installation of clevis pin at bell crank.

3. After adjusting bell crank position as described in step 2 above, unhook lever spring and remove clevis pin (9, fig. 4). Check toggle lever (17, fig. 4) to make certain lever is in solid contact with stop stud. Hold clevis (8, fig. 4) at toggle lever and try inserting clevis pin. If pin is not a free fit through clevis and lever, loosen lock nut at spring clip and turn adjustable clevis as necessary to allow clevis pin to enter freely. Install clevis pin and cotter pin. Position the spring clip and tighten clevis lock nut, then install lever spring.

Adjustment to Set Release Bearing Clearance

The adjusting handle (2, fig. 4) provides a simple means for adjusting release bearing clearance.

At regular intervals, check the free play of clutch release lever (1, fig. 4). "Free play" means

the distance the top of clutch release lever moves before the release bearing contacts clutch release lever buttons (23, fig. 1). Free play will normally become less as wear at clutch disc facings occurs. The checking tool illustrated in figure 7 can be made to the dimensions shown and used to determine if release lever free play is correct.

Check free play and make adjustment as follows:

1. In engine compartment, unhook lever spring (22, fig. 4), then push release lever away from adjusting handle until it is stopped as release bearing contacts clutch release lever buttons. Try inserting the tool (fig. 7) between adjusting handle and release lever.

2. Turn adjusting handle as necessary to just admit the tool between end of wedge on adjusting handle and face of release lever.

3. Remove tool and install lever spring (22, fig. 4). Be sure the wedged end of adjusting handle engages mating notches in release lever.

REPOSITIONING RELEASE SHAFT LEVER

As clutch facings wear, point "X" (fig. 6) normally moves toward the assist unit with each succeeding release bearing clearance adjustment. This point, which is the point on release lever (2) contacted by adjusting handle (4), must be within the dimension shown for "A" in figure 6 when clutch is engaged. To determine if lever (2) should be repositioned, measure horizontal distance from center of 3rd and 4th shift lever stud (5) in transmission to point "X" when clutch is engaged and release bearing (13, fig. 1) is in contact with release lever buttons. If the distance is less than 2.20 inches, release lever must be repositioned on release yoke shaft (1, fig. 6) as follows:

Key numbers in text refer to figure 6 unless otherwise indicated.

1. Unhook release lever return spring (8), and remove clevis bolt (21, fig. 4).

2. Loosen clamp bolt securing release lever (2) to shaft (1), and mark lever (2) and end of shaft (1) to show original relationship.

3. Pry release lever (2) off shaft (1), move top of lever toward engine one serration from original position as marked in step 2, and reinstall lever on shaft.

4. Check position of point "X" which must be not more than 4-1/2 inches from line "C," with release bearing contacting clutch release lever thrust buttons. Tighten release lever clamp bolt to 35 to 45 foot-pounds torque. Install clevis bolt (21, fig. 4) and tighten nut to 40 foot-pounds with torque wrench.

5. Adjust release bearing clearance as previously instructed.

NOTE: Release lever (2) cannot repeatedly be repositioned. After lever has been repositioned

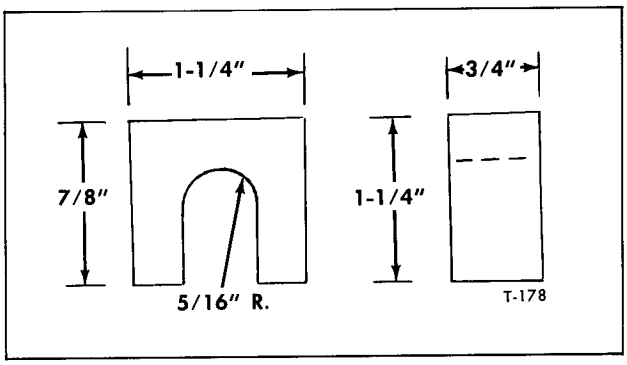


Figure 7—Improvised Tool (Gauge) For Measuring Release Lever Free Play

once and normal wear has caused point "X" to reach maximum limit as shown for dimension "A" on figure 6, it must be determined whether there is sufficient clearance between the clutch release levers (32, fig. 1) and clutch cover (12) fig. 1) to warrant repositioning lever again. This can be checked through opening in clutch housing after removing screened cover from housing (14, fig. 1). If clearance is less than 3/16 inch, new clutch disc and facing assemblies must be installed, unless release levers are reset as directed below under "Resetting Release Levers." After installing new facings or resetting release levers, release lever will require repositioning to bring point "X" within the proper operating range.

RESETTING RELEASE LEVERS

If it is desired to completely wear out clutch facings, the clutch release levers can be reset once during the life of clutch. Check lever position and reset as directed below.

1. Through inspection hole in clutch housing measure distance from edge of clutch cover to lever at point indicated in figure 8.

2. With sharp tool mark one corner of one hex adjusting nut and the steel thrust plate. Unscrew adjusting nut exactly two turns, using markings for

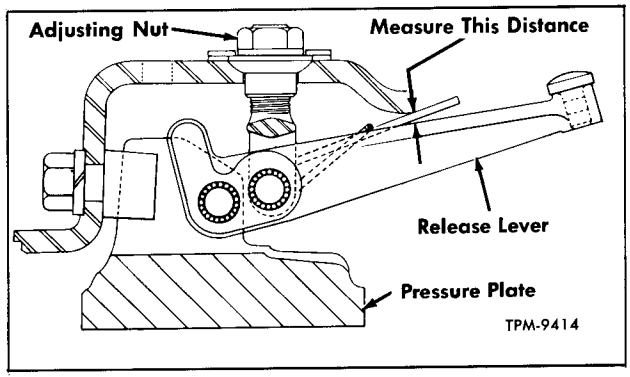
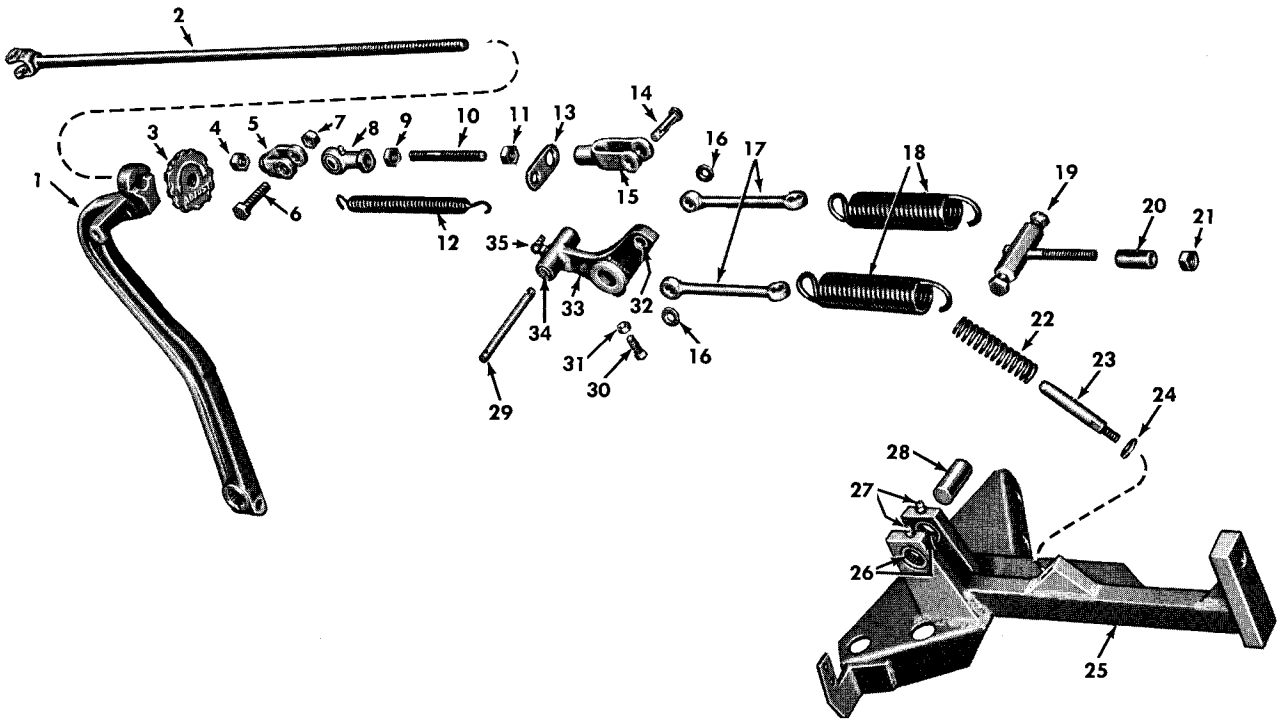


Figure 8—Point of Measurement For Resetting Release Levers



1 Clutch Release Lever
2 Clutch Release Rod
3 Adjusting Handle
4 Lock Nut
5 Clevis (Short)
6 Clevis Bolt
7 Clevis Bolt Nut
8 Rod End Bearing
9 Lock Nut
10 Assist Rod
11 Lock Nut
12 Lever Spring
13 Spring Clip
14 Clevis Pin
15 Adjustable Clevis
16 Flat Washer
17 Link
18 Assist Springs
19 Anchor and Bolt Assembly (Welded)
20 Spacer
21 Anchor Nut
22 Stop Stud Spring
23 Stop Stud
24 Washer
25 Bracket Assembly (Welded)
26 Shaft Bearings
27 Lubrication Fitting
28 Toggle Lever Shaft
29 Toggle Lever Pin
30 Set Screw
31 Lock Nut
32 Bushing (In Lever)
33 Toggle Lever
34 Bearings
35 Lubrication Fittings
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Figure 9—Clutch Release Assist Mechanism Disassembled

reference. Mark with paint to indicate lever has been reset (so that a second readjustment will not be made).

3. With starter, turn flywheel to bring next adjusting nut into view, then repeat step 2 until all six levers have been readjusted. Perform lever readjustment with care to maintain the lever "in-plane" condition.

CAUTION: The foregoing procedure may be used ONLY ONCE during life of a set of clutch disc facings. When levers have been reset as directed above, mark the clutch assembly in some manner so a second resetting will not be made. If levers are reset a second time, damage will result from rivet heads contacting driving members.

4. Reposition release shaft lever to locate point "X" (fig. 6) within proper operating range. Refer to "Repositioning Release Shaft Lever" covered previously in this section.

CLUTCH RELEASE ASSIST MECHANISM REPLACEMENT

REMOVAL

Key numbers in text refer to figure 4.

The assist mechanism may be removed from the transmission as an assembly by following the instructions below.

1. Unhook and remove lever spring (22).
2. Remove clevis bolt (21).
3. If vehicle is equipped with speedometer sending unit mounted on assist unit bracket, disconnect wiring and remove the sending unit.
4. Remove the bolts and washers (10) which

attach bracket (11) to transmission. The two bolts and washers near reverse solenoid are reached by use of socket wrench through holes in top of bracket. Remove bracket assembly from transmission.

DISASSEMBLY

Whenever it is necessary to disassemble the clutch release assist mechanism, follow the procedure given below referring to figure 4 for identification of parts.

IMPORTANT: Grip bracket in vise and while holding anchor and bolt assembly to prevent its turning, remove nut (15) from anchor bolt. This will relieve tension on springs (12) and prevent possible injury which could occur if toggle lever (17) should be inadvertantly forced past center.

1. With nut (15) removed from anchor bolt, remove anchor (13) and spacer (14), then remove springs (12) by disengaging spring hooks from links (7).

2. Remove clevis pin (9) and remove assist rod (20) with rod end bearing (4) and clevis (8).

3. Remove cotter pin from one end of toggle lever pin (18), then remove pin, spring links (7), and flat washers (6) from toggle lever.

4. Remove set screw which locks toggle lever to shaft, then remove shaft from bracket. Remove toggle lever.

5. Remove spring from stop stud (16), then use wrench on flat section at bracket and remove stud and washer.

INSPECTION AND REPAIR OF ASSIST MECHANISM

Key numbers refer to figure 9.

1. Clean all parts thoroughly to permit visual inspection.

2. Inspect pin (29) and shaft (28) at areas contacted by bearing needles. Obtain new parts if required.

3. Inspect needle bearing assemblies (26) in bracket (25). If bearings are worn, or if they are otherwise damaged, new bearing assemblies should be installed.

Bearing replacement may be made as follows:

a. Insert a suitable spacing block between the two upright supports in which bearings (26) are installed, then press each bearing out of bracket with suitable driver.

b. Locate one bearing (26) at bore in support, with lubricant hole in bearing case aligned with lube fitting hole in support; and apply pressure at lettered or numbered side of bearing to install each bearing assembly.

NOTE: After bearings (26) are installed, set toggle lever (33) in operating position in bracket and temporarily insert shaft (28) through bearings and lever. Check lever for free movement. If there is any binding, the cause must be determined and necessary corrections made to assure free operation of lever.

4. If needle bearings (34) in toggle lever are worn or otherwise damaged, remove bearings and press in new ones. Ends of bearing cage should be flush with surface of lever bore.

5. Examine springs (18), links (17), and anchor (19) for evidence of wear and for bent condition. Replace any parts found to be damaged or worn.

6. Check for looseness of spherical insert in rod end bearing (8). If there is excessive looseness, replace the complete assembly.

ASSEMBLING ASSIST MECHANISM

Key numbers in text refer to figure 9.

1. Install stop stud and washer (23 and 24) in threaded hole in bracket (25).

2. While holding toggle lever in position in bracket, insert toggle lever shaft (28) through bearings and lever (33). Install lock nut (31) on set screw (30), then with hole in shaft (28) aligned with set screw hole in toggle lever (33), install set screw. Be sure end of set screw engages hole in shaft (28). Tighten set screw firmly then tighten set screw lock nut (31).

3. Insert toggle lever pin (29) through bearings in toggle lever, then install spring link (17) on each end of pin and secure each link with flat washer and cotter pin.

4. Assemble rod end bearing (8), spring clip (13) and adjustable clevis (15) with lock nuts (9 and 11) on assist rod (10); then attach these assembled parts to toggle lever (33) using clevis pin (14) secured with cotter pin.

NOTE: When assembling parts on assist rod (10) the rod end bearing (8) should be installed on end of rod with shorter thread. Clevis (15) is adjusted when the assembly is installed on coach.

5. Place spring (22) on stop stud, then hook springs (18) in links (17), place spacer (20) on anchor bolt and start anchor into hole in bracket (25). Hook springs (18) to anchor (19), then push anchor bolt through bracket and start nut (21) on bolt. Hold anchor and bolt assembly (19) and tighten nut on anchor bolt to 10 to 14 foot-pounds with torque wrench.

6. Apply lubricant with gun through the four fittings and lubricate clevis pin with oil.

INSTALLATION

Key numbers in text refer to figure 4.

1. Locate assist mechanism at transmission cover and start mounting bolts with flat washers and lock washers (10). When all mounting bolts have been started, tighten bolts to 50 to 60 foot-pounds.

2. If so equipped, install speedometer sending unit and connect wiring and drive cable.

3. Check lock nut (5) at clevis (3). Be sure that clevis yoke is in vertical position and lock nut is firmly tightened.

4. Remove clevis pin (9), then install bolt (21) to attach rod end bearing (4) to clevis (3). Lubrication fitting on bearing must be on top. Tighten clevis bolt (21) to 40 foot-pounds torque.

5. Check linkage at front end and at bell crank on engine compartment bulkhead to see that linkage is properly adjusted, before installing clevis pin (9) at toggle lever. Clutch pedal lever must be held at the 5-inch dimension from floor as shown in figure 3, and bell crank position must be located as shown in figure 5. Check to see that toggle lever (17) is resting against stop stud (16). Adjust clevis (8) to permit pin (9) to enter freely through clevis and toggle lever. Install clevis pin and tighten lock nuts (5) at spring clip (19).

6. Adjust release bearing clearance with adjusting handle (2), then install lever spring (22).

CLUTCH REMOVAL AND OVERHAUL

To remove and overhaul the clutch assembly follow the procedure previously given in this section to remove the clutch release mechanism, then accomplish the clutch removal and overhaul operations as given in Maintenance Manual X-6114 to remove, inspect, and overhaul the clutch and release mechanism at engine flywheel and in clutch housing.

NOTE: In addition to the inspection procedure given in X-6114, the driven disc assemblies should be inspected for broken or loose damper springs at hubs. If springs are broken or damaged, it will be necessary to replace the springs or install new disc assemblies when assembling clutch to flywheel.

SPECIFICATIONS

CLUTCH ASSEMBLY

Clutch Mfr.	Long Mfg. Div.
Mfr. No.	C-50-B-163
Type	Direct-Pressure with Two Driven Discs
Size	15-Inch

Clutch Driven Discs:

Number Used	2
Front Driven Disc No. (Stamped)	C-46-413
Rear Driven Disc No. (Stamped)	C-46-414
Thickness (each disc)	0.4350"-0.4450"

Flywheel and Drive (Center) Plate:

Width of Drive Slots in Flywheel	1.750"-1.756"
Width of Drive Lugs on Drive Plate	1.740"-1.743"

Clearance Between:

Drive (Center) Plate Lugs and Flywheel Slots	0.007"-0.016"

CLUTCH RELEASE LINKAGE

Type	Manual
Stop Stud Spring:	
Free Length	3.38"
Assist Springs:	
Free Length	6.20"
Length Under 140-160 Lbs.	8"
Toggle Lever Shaft:	
Length	1.740"
O.D.	0.8750"-0.8745"
Toggle Lever Shaft Bearings:	
Type	Needle Roller
Number Used	2
Bearing Assembly No.	148576
Toggle Lever Pin Bearings:	
Type	Needle Roller
Number Used	2
Bearing Assembly No.	451995
Rod End Bearing Assembly (Item 4, Fig. 4):	
Part No.	2194155

Electrical System

IMPORTANT: The electrical system on these coaches is NEGATIVE GROUND. If batteries are not connected for a NEGATIVE GROUND system, severe damage to the generator, regulator, batteries and battery cables will result.

Electrical System information contained in Maintenance Manual X-6114 (Pages 1 thru 66) is also applicable to Electrical System information covered by this supplement with the following exceptions:

ELECTRICAL CIRCUIT DIAGRAMS

Wiring diagrams, inserted in the back of this manual or Maintenance Manual X-6114 (when specified), include all standard diagrams, and the most commonly used special equipment, such as parking brake alarm and automatic engine shut-off systems. Due to the many various combinations and types of special equipment used, it is impractical to include all special equipment wiring diagrams in this manual.

Each operator can obtain wiring diagrams covering his particular special equipment upon request from the factory. Following is a list of wiring diagrams included in this manual or applicable wiring diagrams included in Maintenance Manual X-6114, with a brief outline of the units shown on each diagram.

Engine Control and Generator Wiring Diagrams

MD-90625 - This diagram shows standard circuits used in the engine control and generating system.

MD-90905 - This diagram shows standard circuits, plus automatic engine shut-off system using time delay relay.

MD-93225 - This diagram shows standard circuits, plus automatic engine shut-off system using "Moto-Gard" relay.

Alarm and Signal Wiring Diagrams

MD-88616 - This diagram is in the back of Maintenance Manual X-6114 and shows standard circuits, used in the alarm and signal system.

MD-88871 - This diagram, shown in the back of Maintenance Manual X-6114, shows standard circuits, plus circuits used with automatic engine shut-off system.

MD-89302 - This diagram, shown in the back of Maintenance Manual X-6114, shows alarm and signal circuits used on Greyhound coaches.

Coach Lighting Wiring Diagrams

MD-90615 - This diagram shows lighting circuits used on standard coaches.

MD-90614 - This diagram shows lighting circuits used on Greyhound coaches.

MD-89563 - This diagram, shown in the back of Maintenance Manual X-6114, shows a typical seat lighting circuit.

MD-88755 - This diagram shows a standard stop and directional signal lamp circuit.

MD-90914 - This diagram shows the stop and directional lamp circuit with emergency flasher.

MD-95120 - This diagram shows the stop and directional lamp circuit used on Greyhound coaches.

Transmission Wiring Diagram

MD-88754 - This diagram, shown in the back of Maintenance Manual X-6114, shows the transmission electrical circuit.

Speedometer Wiring Diagrams

MD-88753 - This diagram, shown in the back of Maintenance Manual X-6114, shows circuit for electrical speedometer.

MD-94523 - This diagram shows the speedometer electrical circuit used on Greyhound coaches.

Heating and Air Conditioning Wiring Diagrams

MD-90906 - This diagram shows electrical circuits for standard heating and air conditioning circuits.

MD-90907 - This diagram shows electrical circuits for standard heating and air conditioning, plus circuits for remote control rheostat.

MD-90917 - This diagram shows electrical circuits for heating and air conditioning used on Greyhound coaches.

MD-95102 - This diagram shows heating and air conditioning electrical circuits with heat control relay used on Greyhound coaches.

ELECTRICAL SYSTEM

Lavatory Wiring Diagram
MD-93902 - This diagram shows electrical circuits for coaches equipped with lavatory.

Radio and Public Address System Wiring Diagram
MD-93507 - This diagram shows typical electrical circuits for coaches equipped with radio and public address system.

Parking Brake Alarm Wiring Diagrams
MD-89223 - This diagram shows electrical circuits for coaches equipped with parking brake alarm system.
MD-95106 - This diagram shows electrical circuits for Greyhound coaches equipped with parking brake alarm system.

Fire Alarm Wiring Diagram
MD-89072 - This diagram shows typical electrical circuit for coaches equipped with fire alarm system.

DRIVER'S CONTROL PANEL JUNCTIONS

The "Driver's Control Panel Junctions" are the same as shown on pages 4 through 8 in ELECTRICAL (SEC. 7) in Maintenance Manual X-6114 except as shown below:

Term. No.	Circuit	Wire Size & Color
24	From Ventilation Switch Contact No. 3 to Ventilation Comp't. Jct. 2	12 Orange
30	Spare (Radio SL)	16 Natural
39	Spare	
42	Charging Circuit:	
	From Ventilation Switch "BATT" Terminal	14 Brown-Natural Tr.
	From No Charge Tell-tale Light	16 Brown-Blk. Tr.
	To Ventilation Comp't. Jct. 4	14 Brown-Natural Tr.
	From Temperature Control Rheostat	16 Brown-Natural Tr.
49	From Fast Idle Relay to Magnet Valve	16 Orange-Red Tr.
52	From Accelerator Switch to A/C Overrule Tell-tale	16 Grn.-2 Blk. // Tr.
62	From Circuit Breaker #1 to Generator Tell-tale Resistor	16 Grn.-Blk. Tr. Natural
	From Circuit Breaker #1 to Generator No Charge Tell-tale Light	16 Grn.-Blk. Tr.
73	From Emergency Flasher "L" Terminal to Emergency Flasher Signal Switch	16 Yellow
83	Spare (Radio SL)	16 Natural-Red Tr.

DRIVER'S CONTROL PANEL CIRCUIT BREAKERS

Driver's control panel circuit breakers are the same as shown on page 9 in ELECTRICAL (SEC. 7) in Maintenance Manual X-6114 except as shown below:

Circuit Breaker No.	Circuit	Wire Size & Color	Feed From
18	Headlamp Switch (Jct. 86)	No. 12 Green	No. 1 on Master Switch
20	Headlamp Switch (Jct. 86)	No. 14 Blk.-2 Grn. // Tr.	Battery
21	To Fire Alarm Bell (If Used)	No. 14 Natural	Battery

ELECTRICAL COMPARTMENT JUNCTION PANEL

The "Electrical Compartment Junction Box" is the same as shown in Figure 6 in ELECTRICAL (SEC. 7) in Maintenance Manual X-6114 except 'Resistor No. 14' and 'Lavatory Time Delay Relay - No. 15' have been removed.

Electrical Compartment Junctions are the same as shown on pages 11 through 13 in ELECTRICAL (SEC. 7) in Maintenance Manual X-6114 except as shown on following page:

Term. No.	Circuit	Wire Size & Color
4	Air Conditioning System:	
	From Condenser Radiator Switch	14 Black-Green Ch.
	To Splice for Hi-Lo and Air Pressure Switch	14 Black
6	To Center Lavatory Compartment Light	16 Nat.-Black Tr.
	To Marker Light	16 Nat.-Black Tr.
12	Open	
34	Air Conditioning Stop Tell-tale Lamp Circuit:	
	From Hi-Lo Pressure Switch Terminal "M1"	No. 16 Black
	To Driver's Control Panel Jct. 34	No. 16 Blk.-2 Red // Tr.
38	To Occupied Sign Lights	No. 16 Grn.-Red Ch.
	From Blower Relay "VAC"	No. 16 Grn.-Red Ch.
	To Connector for Lavatory Sign Lights	No. 16 Grn.-Red Ch.
39	From #6 Circuit Breaker	No. 14 Natural
	To Switch For Lavatory Occupied Sign	No. 16-Natural
	To Lavatory Emergency Switch	No. 16 Natural
41	Stop Lamp Relay Power Supply	
	From Stop Lamp Switch	No. 14 Black
	To Stop Lamp Relay Terminal "B"	No. 14 Grn.-2 Blk. // Tr.
42	Generating System Circuits:	
	From Driver's Control Panel Jct. 42	No. 12 Brn.-Blk. Tr.
	From Regulator Sensing Relay "C" Terminal	No. 16 Black
	To Circuit Breaker No. 10	No. 12 Brn.-Blk. Tr.
	To Water Pump Switch	No. 16 Black
47	From Driver's Control Panel Jct. 47:	
	To Transmission Amphenol Plug Pin "E"	No. 16 Green
60	Engine Stop Overrule Circuit:	
	From Engine Shut-off Relay "D" Terminal	No. 14 Black
	From Engine Control Switch	No. 16 Black
	From Driver's Control Jct. 60	No. 16 Brown
	To Engine Stop Solenoid	No. 16 Black

ELECTRICAL COMPARTMENT CIRCUIT BREAKERS

Electrical Compartment Circuit Breakers are the same as shown in figure 7 in ELECTRICAL (SEC. 7) in Maintenance Manual X-6114.

Circuit Breakers are the same as shown on pages 14 and 15 in ELECTRICAL (SEC. 7) in Maintenance Manual X-6114 except as shown below:

Circuit Breaker No.	Circuit	Wire Size & Color	Feed From
6	To "BATT" Terminal of Lavatory Control Relay	No. 14 Natural	Battery
	Feed for Door and Emergency Switches of Lavatory	No. 14 Natural	Battery
12	To Engine Comp't. Amphenol Plug Pin "I"	No. 10 Nat.-Grn. Cr. Tr.	

AMPHENOL CONNECTORS

All amphenol connectors are the same as previously covered on pages 16 and 17 in ELECTRICAL (SEC. 7) in Maintenance Manual X-6114 except for "Engine Amphenol Connector" (Terminal "B").

ENGINE AMPHENOL CONNECTOR

Terminal Letter	Circuit	Wire Size & Color
B	Generator Relay Circuit:	
	From Generator Relay Terminal	No. 14 Black
	To Starter Control and Generator Relay Jct. 4	No. 14 Nat.-Grn. & Red Cr. Tr.

ELECTRICAL SYSTEM

AUTOMATIC ENGINE SHUT-OFF SYSTEM

Refer to "Engine Control and Generator Wiring Diagrams" in back of this manual and alarm and signal wiring diagrams in back of Maintenance Manual X-6114 for automatic engine shut-off circuitry.

Refer to pages 19 and 20 in WIRING AND MISCELLANEOUS ELECTRICAL (SEC. 7) in Maintenance Manual X-6114 for automatic Engine shut-off system operation, tests, and adjustments.

RELAYS

RELAY 1115822

Refer to Relay 1115810 in WIRING AND MISCELLANEOUS ELECTRICAL (SEC. 7) in Maintenance Manual X-6114 for description and operation of the relay. Refer to "Specifications" at end of this section for Relay 1115822.

RELAY 1116852

Several of these relays are used on each vehicle. Location and junction of each relay is described on pages 24 and 25 in WIRING AND MISCELLANEOUS ELECTRICAL (SEC. 7) in Maintenance Manual X-6114, except as shown following:

WATER PUMP RELAY

Information is the same as covered on page 25, in WIRING AND MISCELLANEOUS ELECTRICAL (SEC. 7) in Maintenance Manual X-6114, except as follows:

"Driver's Control Panel Junction 64 is connected to ventilation compartment junction 6, then to "N.O.," contact of modulating valve switch.

RADIO AND PUBLIC ADDRESS SYSTEM

Refer to Radio and Public Address System Wiring Diagram MD-93507, in back of this manual, for radio and public address system installation.

SPECIFICATIONS

Wiring and Miscellaneous Specifications remain the same as previously covered in WIRING AND MISCELLANEOUS ELECTRICAL (SEC. 7) in Maintenance Manual X-6114 except a relay 1115822 has replaced the 1115810 relay.

Specifications for the relay stamped 1115822 are the same as specified for relay 1115810 except sealing voltage for the 1115822 relay (large unit) is 5.2 maximum.

Starting System

Starting motor stamped 1114100, covered in this manual, is the same as the starting motor covered in Maintenance Manual X-6114, except as noted below:

MAINTENANCE

Other than periodic lubrication as directed in LUBRICATION (SEC. 13) in Maintenance Manual X-6114 and keeping cable connections clean and tight, the starter should require no periodic maintenance. The brushes can be inspected and replaced without disassembling the starting motor; however, it must be removed from the engine. Starter is accessible through access opening in crossmember underneath the vehicle.

BRUSH REMOVAL

1. Remove starting motor from engine.
2. Loosen two screws holding cover band on commutator end of field frame, then remove cover band.
3. Remove screws and washers attaching brush leads and field coil leads to brush holders.
4. Using a screwdriver as shown in figure 1, bend brush holder spring back and remove brush from holder.

BRUSH INSPECTION

1. When brushes are worn down to less than one-half their original length, they must be replaced (original length is 3/4").
2. Be sure leads are secure in brushes and that clips are properly soldered to leads.

BRUSH INSTALLATION

1. Using screwdriver to bend brush holder spring as shown in figure 1, and with groove in brush aligned with ridge in holder, insert brushes in holders.
2. Position brush leads and field coil leads to brush holders and attach with one screw and washer in each brush. Tighten screws firmly.
3. Position cover band over commutator end of field frame, and tighten cover band screws firmly.
4. Install starting motor on engine.

INSPECTION, TESTS, AND REPAIR

ARMATURE

If the armature commutator is worn, dirty, out-of-round, or has high insulation, the armature should be placed in a lathe and the commutator turned down. Do not cut deeper than necessary to remove rough spots or out-of-round condition. DO

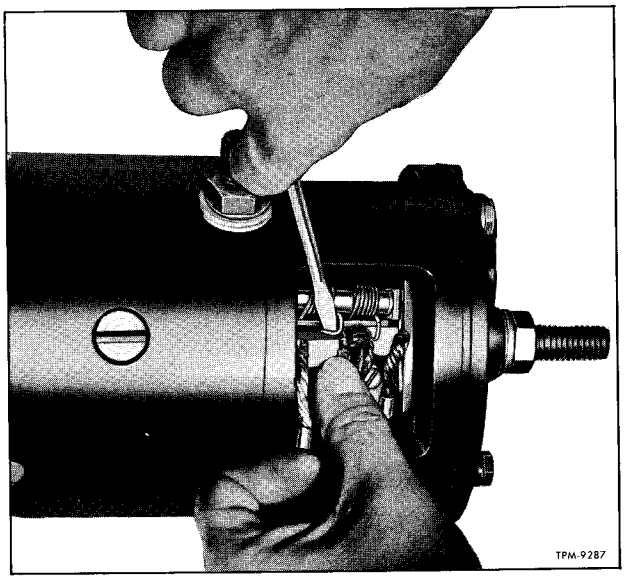


Figure 1—Removing or Installing Brushes

NOT UNDERCUT THE INSULATION BETWEEN THE COMMUTATOR SEGMENTS AFTER TURNING DOWN THE COMMUTATOR AS HAS BEEN THE PRACTICE IN THE PAST.

The armature should be checked for open circuit, short circuit, and grounds as follows:

OVERRUNNING CLUTCH ASSEMBLY

Drive pinion must rotate freely in overrunning direction and must not slip in cranking direction. The overrunning clutch can be serviced as follows, referring to figure 2.

Disassembly

1. Using suitable tools, remove the pinion stop cup and split washers from sleeve.

NOTE: In removing the pinion stop cup, cup will be damaged. Use new cup at assembly.

2. Remove pinion, spring retainer outer cup, spring, and spring retainer inner cup.

Inspection and Repair

1. Inspect spring and spring retainer cups. If not in good usable condition, replace with new parts.

2. Inspect pinion. If teeth are chipped or cracked, replace pinion.

3. Inspect sleeve bushings. If bushings do not meet specifications listed at end of this section, press old bushings out of sleeve and press new bushings into place. Ream bushings to specifications listed at end of this section.

Assembly

1. Install spring retainer inner cup, spring, and spring retainer outer cup on sleeve.

2. Install pinion and pinion stop cup on clutch sleeve.

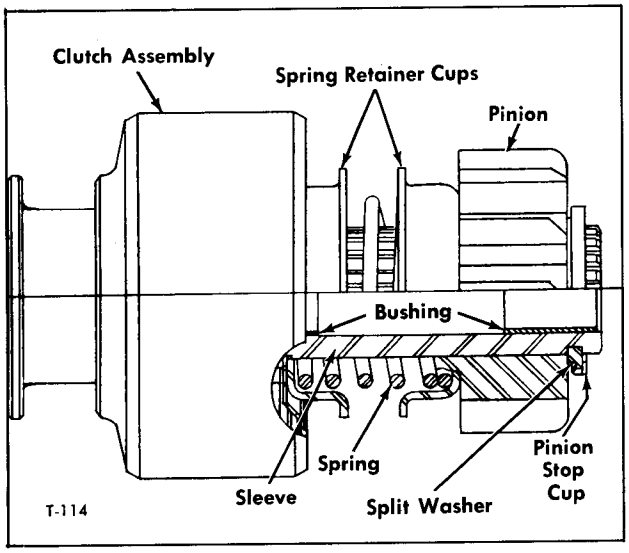


Figure 2—Drive Clutch Assembly

3. Install split-type washers in groove at end of clutch sleeve.

4. Position clutch sleeve assembly in a vise; then with pinion seated firmly against the pinion stop cup, bend pinion stop cup lip over split washers, locking pinion stop and split washers together.

PINION CLEARANCE ADJUSTMENT

1. To check pinion clearance, disconnect the connector strap between solenoid switch and motor frame terminal.

2. Connect a 6-volt battery from solenoid switch terminal to starter frame. If solenoid does not operate, use a 12-volt battery.

3. MOMENTARILY - flash a jumper lead from solenoid "MOTOR" terminal to starter frame. The pinion will shift into cranking position and remain so until the battery is disconnected.

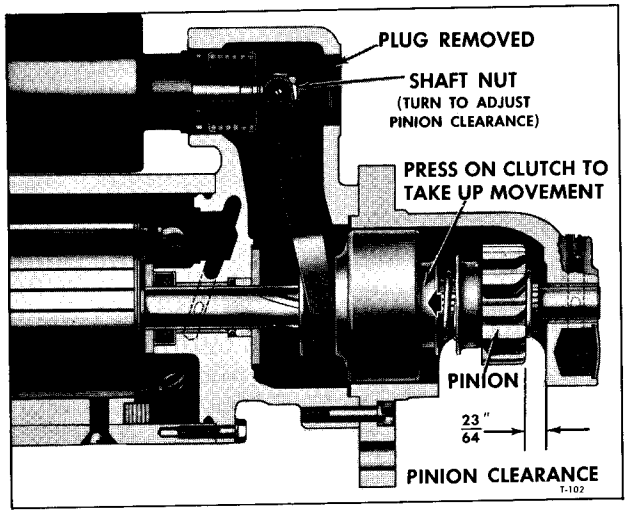


Figure 3—Pinion Clearance Check and Adjustment

CAUTION: To prevent overheating the solenoid switch, DO NOT keep solenoid energized for longer than 1-1/2-minutes without a 2-minute "rest" between.

4. Push the pinion back toward armature to take up slack, then check clearance between pinion and nose housing (fig. 3).

5. Adjust nut on solenoid plunger rod as necessary to obtain clearance of 23/64 inch. Install access plug and gasket in shift lever housing.

NOTE: Magnetic force with hold-in winding energized will prevent plunger from turning.

6. Disconnect battery and reconnect the connector strap.

SPECIFICATIONS

MAKE	Delco-Remy
STARTER MODEL	1114100
ROTATION (VIEWING DRIVE END)	Counterclockwise
MINIMUM BRUSH SPRING TENSION	80 oz.
NO-LOAD TEST	
Volts	11
Maximum Amps.	170
Minimum RPM	6300
LOCK TEST	
Volts	1.5
Maximum Amps.	700
Minimum Torque (Ft. Lbs.)	15
BUSHING DIAMETERS (I.D.)	
Commutator End Frame	0.540"-0.544"
Shift Lever Housing	0.810"-0.813"
Nose Housing	0.625"-0.627"
Drive Clutch Sleeve*	0.6245"-0.6260"
STARTER SOLENOID MODEL	1119895
Current Consumption at 80°F.	
Both Windings	
Amperes	65.3-73.3
Volts	10
Hold-in Winding	
Amperes	12.7-14.3
Volts	10

*Burnish after installing.

Generator

The generator assemblies, stamped 1117677 or 1117678, are basically the same as the generator covered in Maintenance Manual X-6114. All service information in Maintenance Manual X-6114 will apply to generators covered in this supplement.

The generators stamped 1117677 or 1117678 incorporate a 54 slot stator and a new diode and bracket assembly; however all generator maintenance, troubleshooting, and repair information is the same as previously covered in "GENERATOR" (SEC. 7) in Maintenance Manual X-6114.

A 2.75 to 1 ratio external tooth pinion gear is used in the generator stamped 1117678 and a 2.29 to 1 ratio pinion gear is used in the generator stamped 1117677. Refer to figure 4 in this manual for generating system schematic wiring diagram.

Refer to "Specifications" at end of this section for generator specifications.

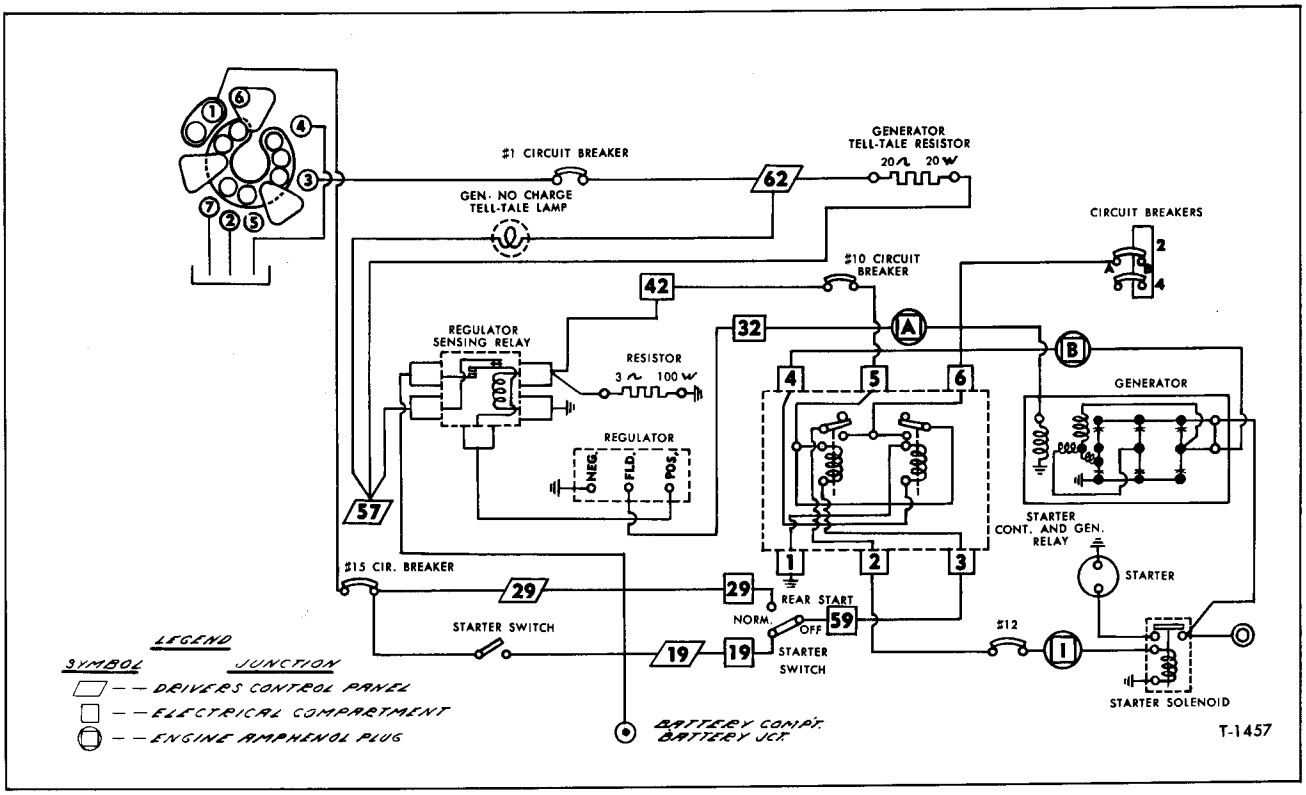


Figure 4—Generator System Schematic Wiring Diagram

SPECIFICATIONS

MAKE	Delco-Remy	Delco-Remy
MODEL NUMBER	1117677	1117678
ROTATION	Either	Either
FIELD CURRENT at 80°F.		
Amperes	8.1 - 8.45	8.1 - 8.45
Volts	12	12
HOT OUTPUT AT 5000 RPM		
Amperes	305	305
Volts	14	14
DRIVE RATIO	2.29:1	2.75:1

Regulator

GENERAL

The transistor regulator used on all vehicles covered by this manual is an assembly composed principally of diodes, condensers, resistors, and transistors. These components are mounted on a printed circuit panel board to form a completely static unit containing no moving parts. Regulator terminal connections are marked "NEG," "FLD," and "POS."

The regulator components work together to limit the generator voltage to a pre-set value by controlling the generator field current. This is the only function the regulator performs in the charging circuit.

The voltage at which the generator operates is determined by the regulator adjustment. Once adjusted, the regulator voltage remains constant, since the regulator is unaffected by length of service, changes in temperature, or changes in generator output and speed.

The primary controlling device for the regulator is the Zener diode (D2). The Zener diode is used as a reference source to sense increasing voltage and to turn on the driver transistor (TR2) which in turn shuts off the power transistors (TR1). With power transistors (TR1) shut off, field current drops until system voltage drops sufficiently to cause the Zener diode (D2) to again allow full field application by the transistors. This action occurs at a varying frequency, depending on generator speed and load.

CAUTION: When performing maintenance on generator or regulator, NEVER ALLOW REGULATOR LEADS TO BECOME GROUNDED.

Figure 5 shows regulator circuitry with each major component identified. Figure 6 shows corresponding items in actual location on panel board in respect to circuitry diagram (fig. 5).

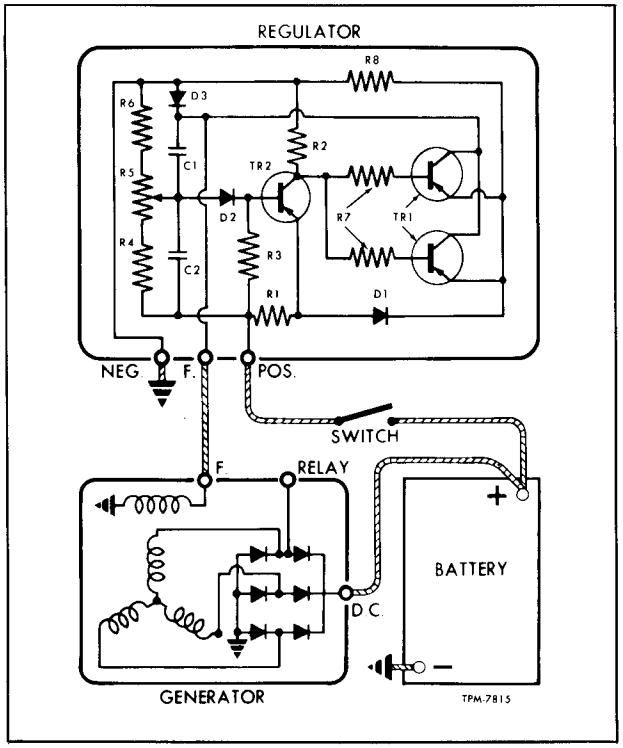


Figure 5—Regulator Circuitry Diagram

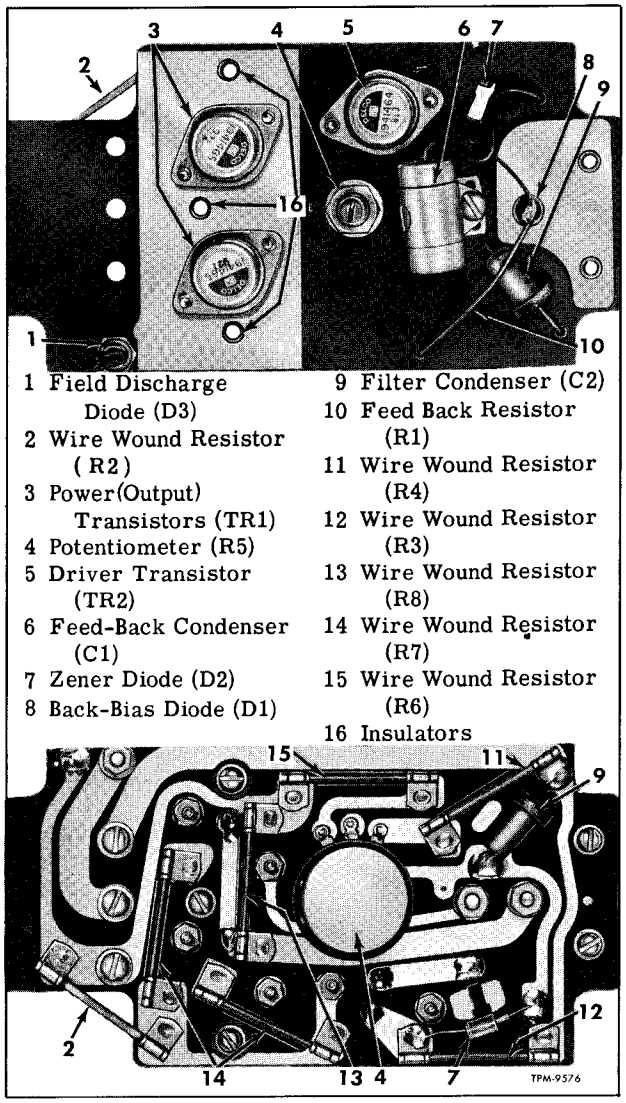


Figure 6—Regulator Components

Regulator is mounted on regulator and blower control panel as shown in figure 6 in "WIRING AND MISCELLANEOUS ELECTRICAL" section. Accessibility to regulator is also described in the same section.

ON VEHICLE ADJUSTMENT

Trouble in the electrical system will usually be indicated by one of two conditions - an undercharged or an overcharged battery. Either condition can result from an improper regulator setting.

The ideal voltage setting is the one which will maintain the batteries in a fully charged condition with a minimum use of water. This setting must be determined by the operator according to the particular type of service under which the coach operates. Check and adjust voltage regulator setting as follows: (See fig. 7 for voltmeter connections.)

1. Connect a voltmeter from regulator "POS" terminal to ground.
2. Start engine and operate at approximately 1000 rpm (about 2300 generator rpm).
3. Turn on vehicle blower motors.
4. Observe voltmeter; a steady reading of 13.7 volts should appear. If this reading is not present, remove plug from regulator and adjust potentiometer (fig. 8) until reading is obtained.

NOTE: In some cases, when maximum special electrical equipment is used and an undercharged battery condition results over a period of time, it may be necessary to adjust regulator to 14 volts. If this is the case, operate vehicle a minimum service period of 48 hours and check for an improved battery condition. The same procedure applies for an overcharged battery, except adjust voltage to 13.4 volts.

5. If voltage cannot be adjusted by turning potentiometer, and it is evident that trouble exists in generating system, check generator as directed in "GENERATOR" section of this manual. If generator is found to be satisfactory, check regulator as directed under "Troubleshooting" below:

TROUBLESHOOTING

Various electrical checks can be made to locate defective components. Components to be checked are identified in figure 6.

The ohmmeter used in the following checks must be accurate, and must be one which uses a 1-1/2 volt dry cell. The milliammeter and voltmeter used in figure 9 are as follows: Milliammeter - use the milliammeter ranges of a Simpson Model 260 Multimeter, or any reliable 0-100 milliampere D.C. meter; voltmeter - use the voltmeter range of a Simpson Model 260 Multimeter, or any 0-15 voltmeter with 10,000 ohms/volt or higher movement. The spare potentiometer used

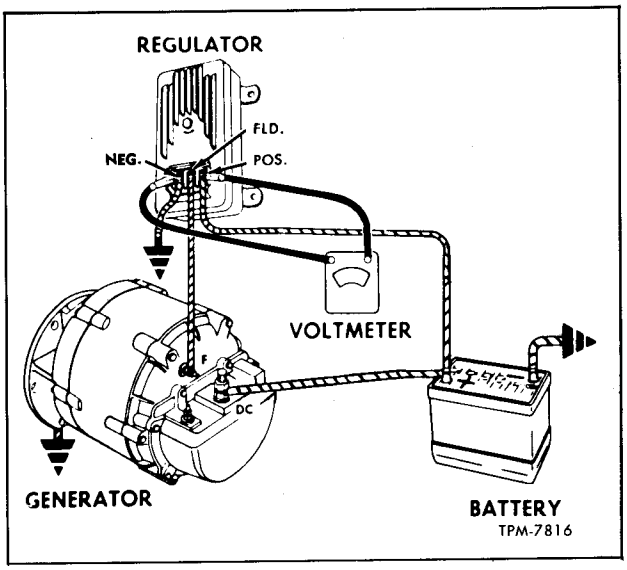


Figure 7—Checking Regulator Voltage Setting

in figure 9 is a 30-ohm, 10-watt unit (part number 1941477).

When making checks, note carefully in the illustrations how the ohmmeter is connected with regards to polarity, and select a scale applicable to check being made.

POLARITY OF OHMMETER MUST BE DETERMINED BEFORE FOLLOWING CHECKS ARE MADE.

To determine polarity of ohmmeter, connect one lead to a known positive (+) lead of a voltmeter and other lead to negative (-) lead of voltmeter. If voltmeter reads up-scale, ohmmeter positive (+) lead is connected to voltmeter positive (+) lead and ohmmeter negative (-) lead is connected to voltmeter negative (-) lead.

It is important that the following checks be made in the order listed. If a defective part is found, replace it before proceeding with the remaining checks. Be sure to make all the checks as more than one component may be defective.

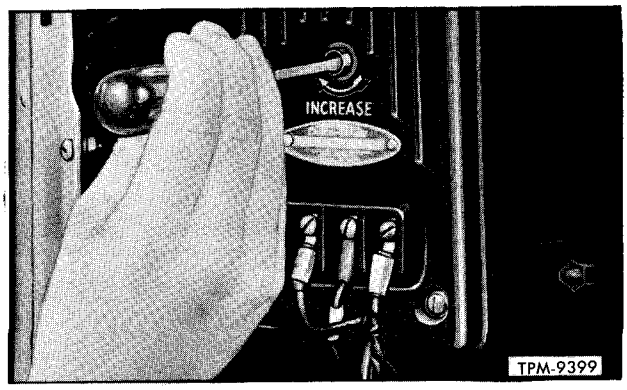


Figure 8—Adjusting Voltage Regulator

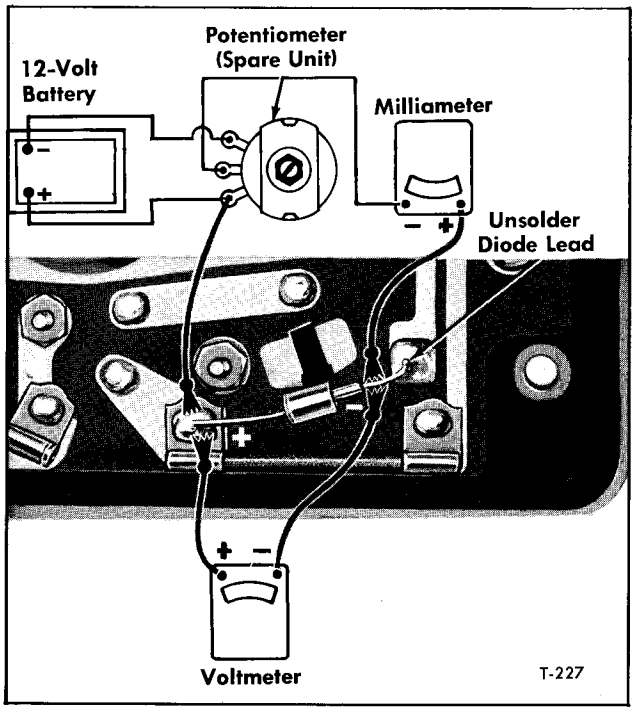


Figure 9—Meter Connection for Checking Zener Diode

A defective part may be replaced by removing any attaching screws involved and/or unsoldering the connections. To replace the parts identified in figure 6, separate the printed circuit board from the cover by removing eight attaching screws. When resoldering, limit solder time to a minimum, as excessive heat may damage the printed circuit and component parts. However, good soldered connections are essential for satisfactory operation. Any good grade of radio-type rosin core solder is recommended. Use soldering iron having sufficient heating capacity to solder or unsolder connection quickly.

ZENER DIODE

To check the Zener diode (7, fig. 6), unsolder the diode lead and lift up just enough to separate from the printed circuit; bending lead too far may cause it to break off inside the diode. Connect instruments as shown in figure 9, then check as follows: Do not attempt to use potentiometer in regulator. Use spare unit.

1. Start with potentiometer at extreme clockwise position.

2. With ammeter set at appropriate scale, rotate potentiometer until milliammeter reads 2

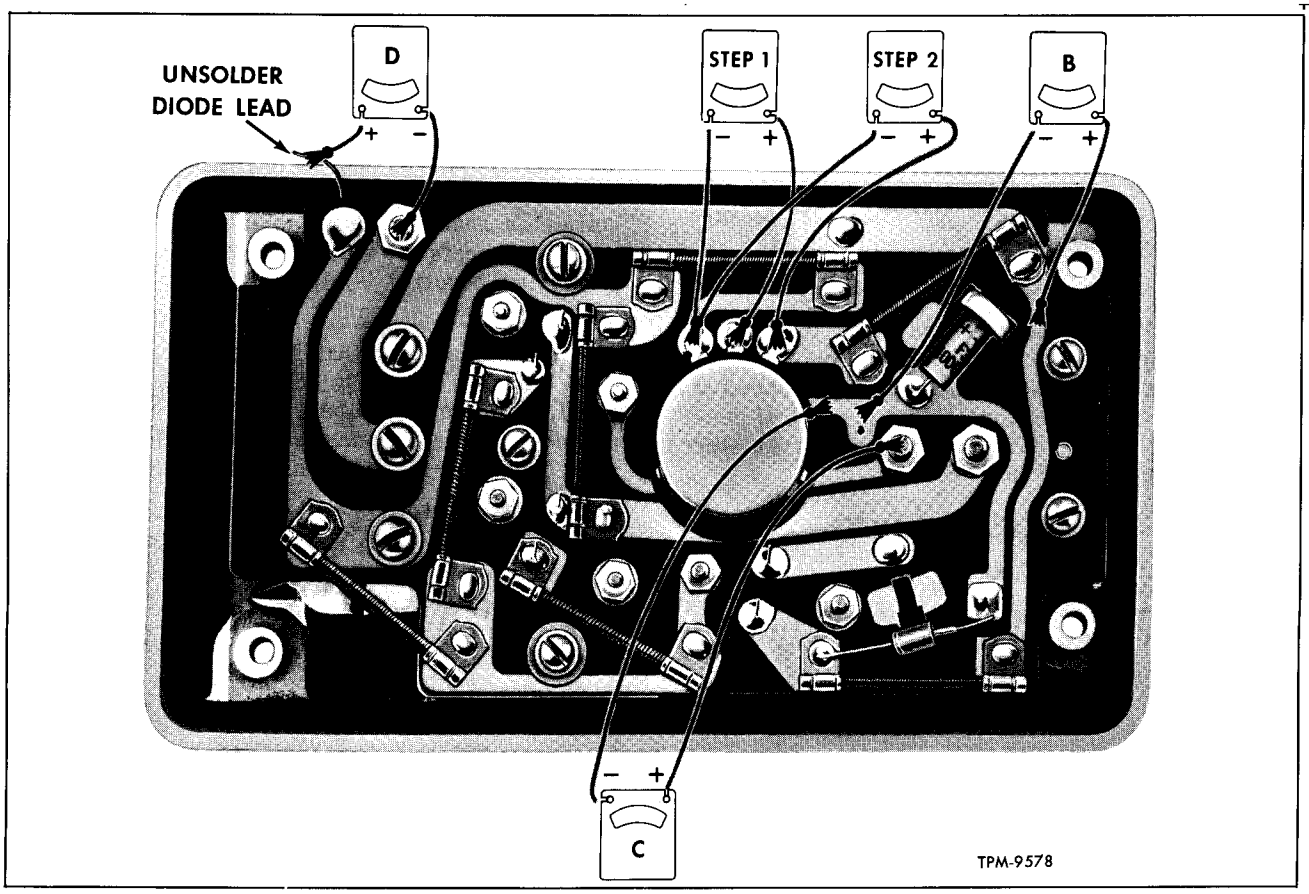


Figure 10—Regulator Component Checks

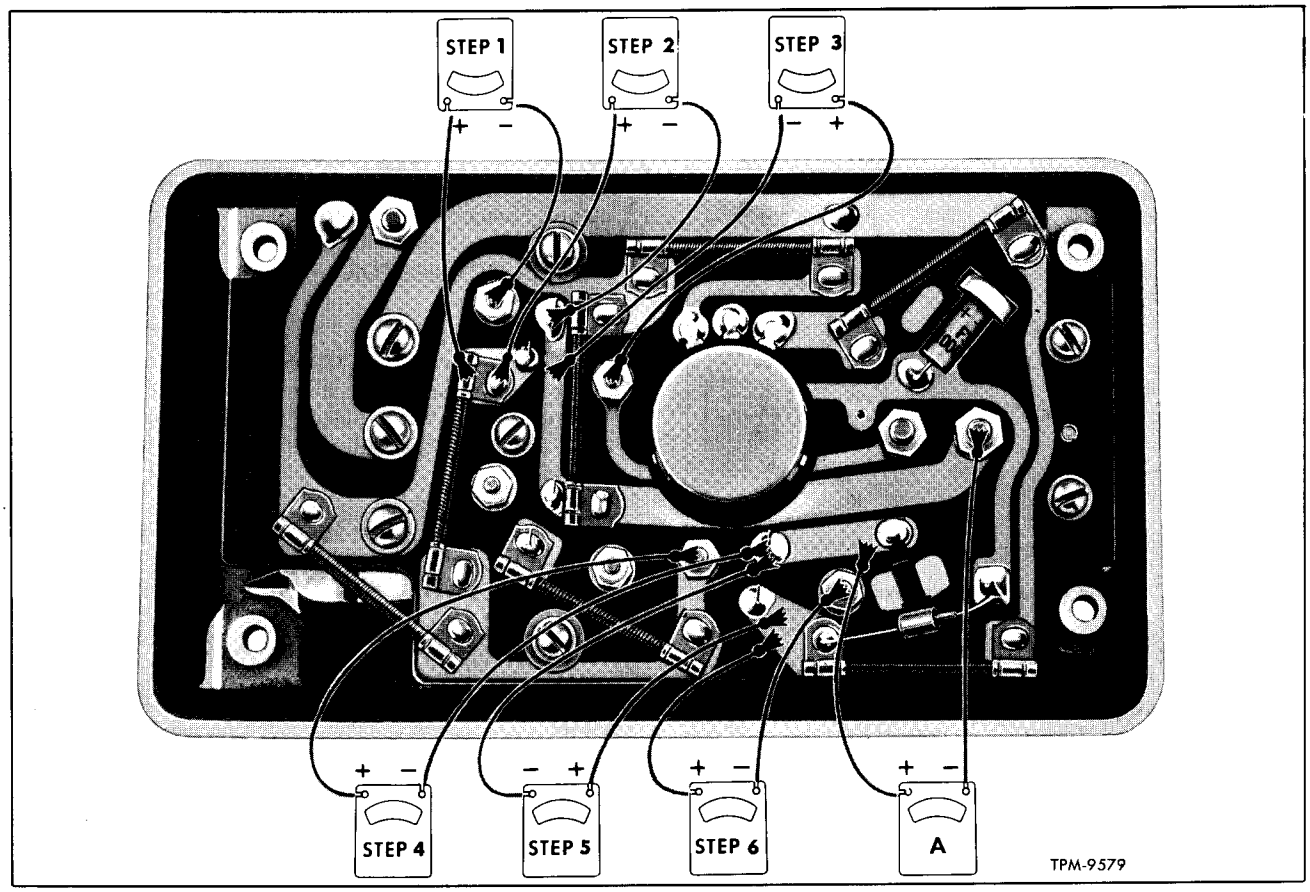


Figure 11—Regulator Component Checks

milliamperes. Read voltmeter - limits are 7.4 volts minimum, 10.0 volts maximum.

3. Rotate potentiometer until milliammeter reads 50 milliamperes. Voltmeter reading must not increase more than 0.5 volt above reading in step 2.

POTENTIOMETER

To check the potentiometer (4, fig. 6), connect ohmmeter leads as shown in Steps 1 and 2 of figure 10. If either reading is 100 ohms or above, potentiometer is open.

FILTER CONDENSER

To check the filter condenser (9, fig. 6), connect ohmmeter leads as shown in Part "B" of figure 10. A zero ohm reading indicates a shorted filter condenser. To check for opens, inspect the two soldered connections for breaks.

FEED-BACK CONDENSER

To check the feed-back condenser (10, fig. 6), connect ohmmeter leads as shown in Part "C" of figure 10. If a zero ohm reading is obtained, condenser is shorted. To check for opens, inspect the soldered connection.

FIELD DISCHARGE DIODE

To check the field discharge diode (1, fig. 6), unsolder lead and connect ohmmeter leads as shown in Part "D" of figure 10. If a zero ohm reading is obtained, diode is shorted. If a very high (infinite) reading is obtained, diode is open.

NOTE: Before proceeding with other check, resolder diode lead.

BACK BIAS DIODE

To check the back bias diode (8, fig. 6), connect ohmmeter leads as shown in Part "A" of figure 11. A zero ohm reading indicates a shorted diode, and reading over 100 ohms indicates an open diode.

POWER TRANSISTORS

Shorted Transistor

Check the power transistors (3, fig. 6), by connecting the ohmmeter the three ways shown in

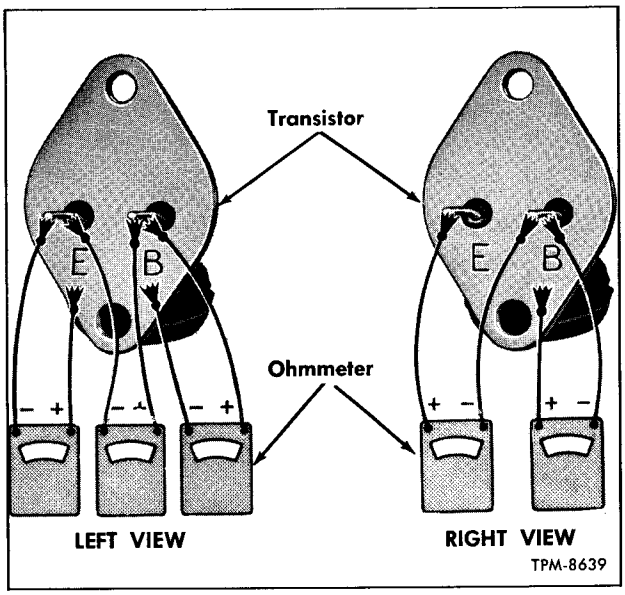


Figure 12—Checking Transistors Removed From Panel Board

Steps 1, 2, and 3 of figure 11. If any reading is zero ohms, one of the power transistors is shorted. To determine which power transistor is shorted, or if both transistors are shorted, remove the upper transistor (3, fig. 6) and repeat the check as shown in figure 11 on the transistor which is still mounted on the printed circuit board. If any of the three readings is zero, the transistor is shorted. Also check the transistor which has been removed by connecting the ohmmeter the three ways shown in left view of figure 12. A zero reading in any one of the three checks indicates a shorted transistor.

Open Transistor

Check power transistors for opens by removing transistor from panel board and connecting ohmmeter to each transistor as shown in right view of figure 12. A very high (infinite) reading in either check indicates an open transistor.

DRIVER TRANSISTOR

Shorted Transistor

Check the driver transistor (5, fig. 6) by connecting ohmmeter as shown in steps 4, 5, and 6 of figure 11. The transistor being checked is shorted if a zero ohm reading is obtained.

Open Transistor

Check the driver transistors for opens as explained under "Power Transistors."

SPECIFICATIONS

MAKE	Delco-Remy
TYPE	Transistorized
MODEL NUMBER	9000551
POLARITY	Negative Ground
QUANTITY OF TRANSISTORS	
Power (Output)	2
Driver	1
VOLTAGE SETTING	13.7 (See text)

Lighting System

GENERAL

Circuits for all lights used for illumination, stop and directional lights, and tell-tale lights, are shown on wiring diagrams in the back of this manual or Maintenance Manual X-6114.

Refer to "Electrical Circuit Diagrams" in "WIRING AND MISCELLANEOUS ELECTRICAL" section of this manual for applicable diagrams.

Refer to "Light Bulb Data" at end of "LIGHTING SYSTEM" in Maintenance Manual X-6114 for bulb sizes of all lights except headlights, lavatory lights, and the rear lounge seat light which are listed at end of this section.

Information contained in "LIGHTING" (SEC. 7) in Maintenance Manual X-6114 is applicable.

LIGHT BULB DATA

	Qty.	Candlepower or Watts	Trade No.
Headlight - Sealed-Beam Unit			
(Inside - Stamped No. 1) . . .	2	37.5	4001-L
(Outside - Stamped No. 2) . .	2	37.50-50W	4002-L
Lavatory Compartment Light .	3	15	93 I.F.
Rear Lounge Seat Light	1	15	93 I.F.

Air Suspension

All information given in Maintenance Manual X-6114 under above subject also applies to vehicles covered by this supplement except as specifically stated in the following procedures.

HEIGHT CONTROL VALVE

DESCRIPTION

Height control valves operate automatically. Valves control the flow of compressed air into or out of bellows. Body of each height control valve contains intake valve, exhaust valve, and delay piston. Overtravel control body contains a spring-loaded nylon piston. Piston protects valve parts when overtravel lever is moved beyond normal operating range, and also provides a delay in the action of the valve so air is not used during momentary bumps, but only on load changes.

Three height control valves are used in each coach air suspension system; one at front axle and two at rear axle. Two different front valves have been used on coaches covered by this supplement. One valve has two air supply outlets (one for each set of bellows, right and left), four nylon ball check valves to prevent flow of air from one set of bellows to the other and two separate valve levers (one intake, one exhaust). Figure 1 shows this type installed. The other front valve is identical in construction with the rear valves. It has one unit which is both an intake valve lever and an exhaust valve lever and it has only one air supply outlet. Figure 2 shows this type installed.

The valve with two outlets and two levers is used on early models. The valve with one outlet and one lever (same as rear valve) is used on late models. Figure 3 shows rear valve installed.

On early models, an air line is connected from each supply outlet to one set of bellows (left and right sides). On late models, the single supply outlet is connected to a "tee" in the delivery line to the bellows on both sides.

Except for valve body and overtravel shaft, parts in all three valves are similar. Early front valve also contains a ball check valve in each inlet port and in each outlet port to prevent passage of air pressure from one side of the vehicle to the other. Each check valve consists of a small nylon ball.

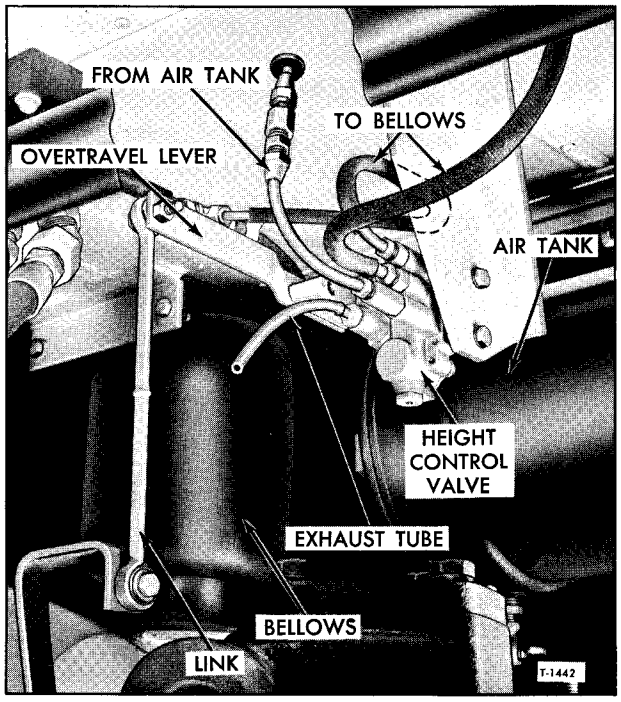


Figure 1—Height Control Valve Installed (Early Model—Front)

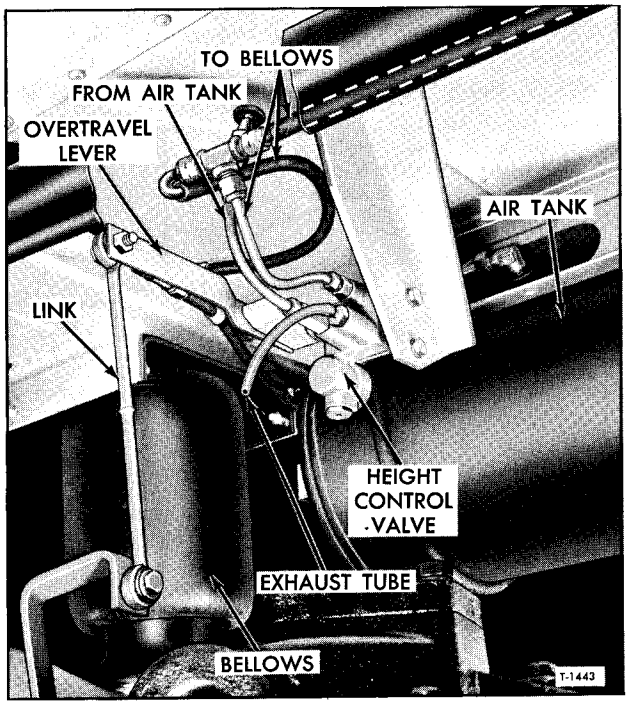


Figure 2—Height Control Valve Installed (Late Model—Front)

AIR SUSPENSION

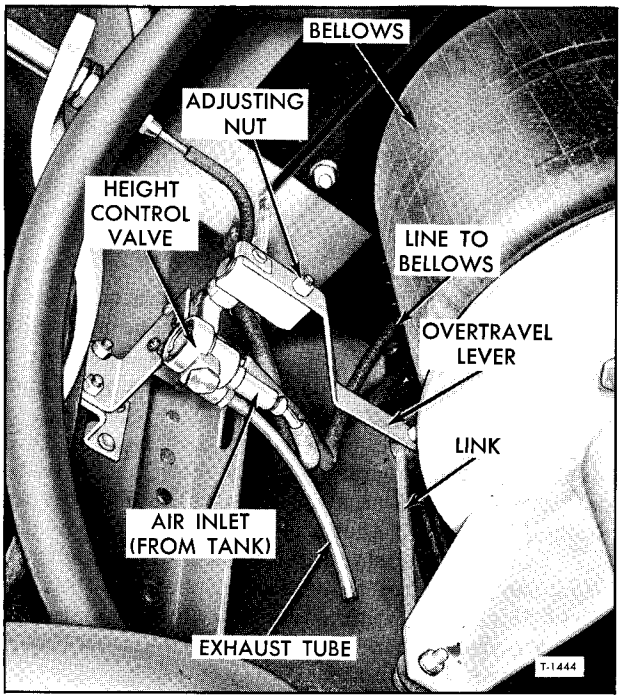


Figure 3—Height Control Valve Installed (All Models—Rear)

HEIGHT CONTROL VALVE OPERATION

Figure 4 shows cross-section of a valve assembly in the three phases of operation. Valve operation is illustrated as coach is unloaded, at normal ride height, and as coach is loaded. Each valve adjusts independently for the following conditions:

LOADING

When coach is loaded, coach body settles. Since valve is linked to suspension, and valve is bolted to body, valve moves downward with body as body is loaded. As overtravel lever and control shaft turns, inlet valve lever moves over against pin of valve core. As pin is pushed in, air pressure flows through height control valve into bellows. Increased air pressure expands bellows and raises body.

Inlet valve is "protected" by check valve (see figs. 12 and 13) in inlet adapter. Light spring in core freely admits tank air, but return flow of air is blocked.

NEUTRAL POSITION

As increased air pressure expands bellows and lifts body, the height control valve moves upward with body. As body is returning to normal ride height, overtravel arm and shaft return to a neutral position. Inlet valve lever also moves away from inlet valve core and inlet valve closes. This stops the flow of air into the bellows. The exhaust valve remains closed. Since the exhaust valve is closed, and the check valve in the inlet adapter prevents compressed air from returning to tank, air is trapped in bellows and in valve. No further valve action or air pressure change takes place until load is increased or decreased, moving overtravel lever out of neutral position for one second or more to actuate intake valve or exhaust valve.

UNLOADING

When part of load is removed, air pressure in bellows lifts body. Overtravel lever, linked to suspension in rear and to axle in front, is pulled down-

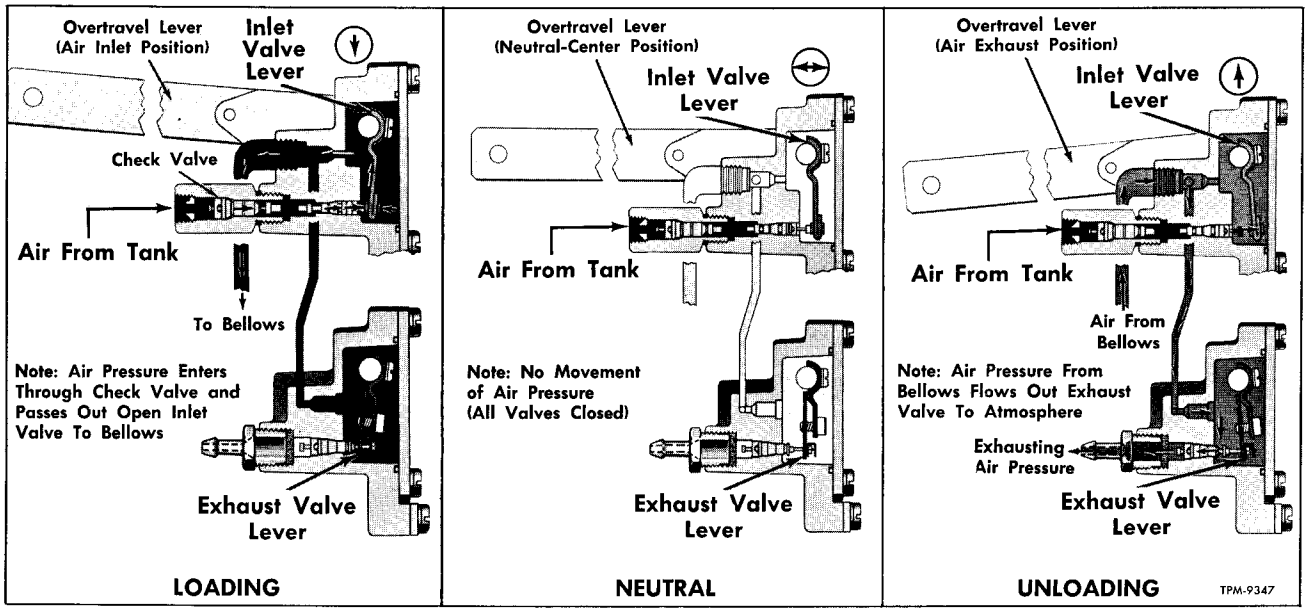


Figure 4—Operation of Height Control Valve

ward from neutral position. This applies a force on the delay piston which moves it slowly. The exhaust valve lever moves with the delay piston. The outer end of exhaust valve lever fits around stem of exhaust valve core. As soon as lever moves beyond free-travel range, lever pulls on stem and opens exhaust valve. Inlet valve remains closed. Compressed air from bellows then flows through the open exhaust valve and out exhaust fitting to atmosphere. As the compressed air is exhausted from bellows, the body lowers until overtravel lever and shaft are again in normal (neutral) position.

OVERTRAVEL LEVER FREE TRAVEL

With vehicle in motion and body at normal ride height, control valve overtravel lever and shaft are in neutral position as shown in figure 4. Small irregularities in road cause slight up and down movement of overtravel lever. Clearances are provided between operating levers and cores of inlet and exhaust valves to permit 3/16" up or down movement of overtravel lever from neutral position without causing valve action. This compensates for small road bumps. The bumps are absorbed by tires and bellows without causing movement of compressed air either into or out of suspension system.

HYDRAULIC DELAYING ACTION

Operation of a delay piston (see figs. 12 and 13) in height control valve prevents change of bellows air pressure as result of momentary road shocks, conserves air pressure, and adds life to valve. The nylon piston moves inside cylinder containing a silicone type fluid. A flapper valve on either end of piston allows displacement of fluid or acts as a check valve, depending on direction piston moves. Delay piston is moved by piston pin (see figs. 12 and 13) that is threaded into overtravel shaft. A one to six second delay results from the closing of one valve to the cracking of other valve. Intake and exhaust valves close from full open position within one second.

Overtravel piston (see figs. 12 and 13) is held against flat side of overtravel shaft by two springs inside piston. Piston keeps overtravel shaft in proper position relative to overtravel lever. Piston also allows overtravel lever to rotate through a complete circle, if necessary, without damaging parts inside valve.

HEIGHT CONTROL VALVE REMOVAL

Before disconnecting any height control valve air lines, securely support body by placing blocks under coach at jack pads. Exhaust air from air supply system by opening drain cock in suspension air tank. After the above precautions have been taken, remove height control valve as follows:

1. Disconnect height control valve overtravel lever from valve link. Pull lever downward to release compressed air from bellows.
2. Disconnect air supply line and bellows air line from height control valve (two lines on early model front valves). Tape ends of all lines closed.
3. Remove two bolts, lock washers, and nuts attaching height control valve to mounting bracket and remove valve assembly.

HEIGHT CONTROL VALVE INSTALLATION

Before installing height control valve assembly, see that air line fittings are clean and undamaged. Replace line connector rubber sleeves if deteriorated or damaged.

DO NOT USE SEALING COMPOUND ON THREADS. Sealer is unnecessary, and if used, may cause valve cores to stick.

IMPORTANT: Absolute cleanliness is essential when installing height control valves. Dirt and sealing compound must be kept out of valves. Even minute particles of foreign matter may become lodged in valve cores or flapper valves and may seriously affect operation of suspension system.

The difference in height control valves is explained previously in "Description." Install valves as follows:

1. Position height control valve at mounting bracket. Attach with two bolts, nuts, and lock washers and tighten to torque listed in "Specifications" at end of this section.
2. Connect air supply line to intake check valve adapter. Connect bellows air line (two at front valve on early models) to outlet adapter. Tighten air line connector nuts firmly.
3. Connect height control valve overtravel lever to valve link. Build up air pressure in system and test for leaks. Check ride height dimensions. Make adjustments as directed following:

HEIGHT CONTROL VALVE AIR LEAKAGE CHECK

NOTE: Air leakage check can be made when valve is installed on vehicle only for bellows mountings and air line connection leaks. The following instructions explain procedure for making air leakage check when valve assembly is removed from vehicle.

1. Clean exterior of valve assembly.
2. Connect air pressure line to air inlet port (fig. 5), then open the air pressure (80-110 psi).
3. Submerge valve assembly in a container of water, then watch for air bubbles when the overtravel lever is in the center position. No air should escape from any point of valve assembly.

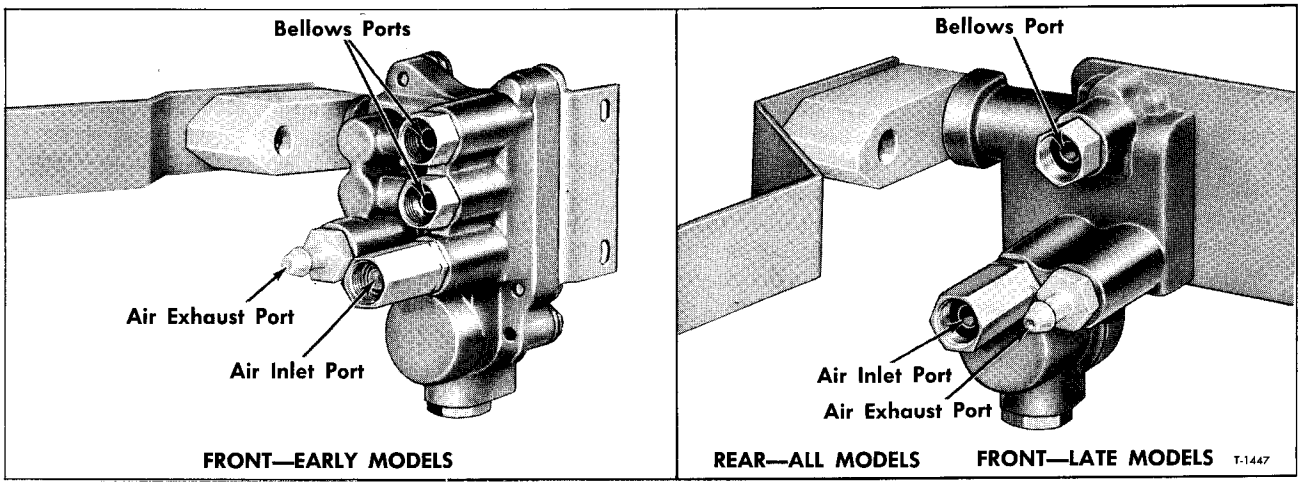


Figure 5—Identification of Valve Air Ports

4. If bubbles appear from the bellows port, this is an indication that the air inlet valve assembly is defective and must be replaced.

5. Remove air pressure line from air inlet fitting and connect it to the bellows port (fig. 5). If bubbles appear at the air inlet check valve port, this is an indication that check valve unit is defective and must be replaced.

6. If bubbles appear at the exhaust port (fig. 5), it is an indication that the exhaust valve assembly is defective and must be replaced.

7. If bubbles appear around edge of valve cover plate, the cover plate rubber O-rings (or gasket) must be replaced.

8. If no leaks are detected, remove valve assembly from the water, then with air pressure still connected to the bellows port, actuate overtravel lever to expel any excessive amount of water which may have entered exhaust valve chamber. Remove air line and connect it to the air inlet port and repeat operation here to remove water from air inlet valve chamber.

HEIGHT CONTROL VALVE ADJUSTMENTS

GENERAL

To properly adjust the height control valve, it is ESSENTIAL that the following procedures be followed and in the sequence mentioned.

Three main adjustments are required:

1. Overtravel lever center position adjustment.
2. Air intake and exhaust valve lever gap adjustments.
3. Time delay check.

NOTE: The height control valve assembly must be removed from vehicle to make the above adjustments.

Instructions for checking the ride height dimension are explained previously under "Ride Height Check and Adjustment."

IMPORTANT: The silicone fluid should be drained from valve assembly before making the first two adjustments mentioned above.

NOTE: The following tools should be used when making valve adjustments.

REQUIRED TOOLS

Tool	Tool Number
Valve Core Replacer	J-6888
Overtravel Lever Piston Compressor	J-8424
Allen Wrenches (Sizes 3/32-inch and 1/8-inch)	Procure locally
Stop Watch	Procure locally
Dial Indicator Set (Having minimum range of 0.200 inch)	Procure locally
Air Line Fitting Assembly Consists of:	
(1) 2-Inch length of 1/4 H-9 hose	Procure locally
(1) Weatherhead pipe fitting	00904-104
(1) Weatherhead inverted fitting	00904-B04
Vacuum Line Fitting	Sun Tester #115-3
Depth Gauge and Straightedge	Procure locally
Conventional Type Eye Dropper	Procure locally

OVERTRAVEL LEVER CENTER POSITION ADJUSTMENT

1. Clean exterior of valve assembly.
2. Remove covers and rubber O-rings from valve assembly, then drain off the silicone fluid.
3. Remove exhaust fitting and exhaust screen from valve.

4. Referring to figure 6, scribe a line 1-3/8-inch from plug end of overtravel lever control body.

5. Place valve assembly in vise as shown in figure 6.

6. If vacuum source is available, attach supply hose to valve exhaust port (fig. 5) using Sun Tester fitting #115-3 or equivalent. Do not apply vacuum at this time.

7. Attach air pressure supply hose to air inlet port (fig. 5). Do not apply pressure at this time.

8. Locate dial indicator in position as shown in figure 6. Move overtravel lever to full air exhaust position - TOP OF DELAY PISTON FLUSH WITH TOP OF BORE - without overtraveling (position "C," fig. 7). Relocate indicator push rod to just contact 1-3/8 inch mark on control body and reset indicator dial to zero (0) at this point (position "C," fig. 7).

9. Move overtravel lever to full air intake position without overtraveling (position "A," fig. 7) (delay piston at bottom of bore). Take indicator reading which may vary from 0.160" to 0.190".

10. Repeat steps 8 and 9 above to recheck this reading.

11. Divide the total travel dimension by two (example: 0.170" ÷ 2 = 0.085"), then move overtravel lever back this amount (0.085") to the center (position "B," fig. 7).

IMPORTANT: Without disturbing lever center position, reset indicator dial to zero (0), which actually is 0.100" on indicator of type registering 0.100" for each revolution of indicator needle, then proceed with valve lever gap adjustments following:

AIR INTAKE AND EXHAUST VALVE LEVER ADJUSTMENTS

IMPORTANT: Before making these adjustments the overtravel lever must be centered as explained previously.

Two methods of adjustment are available:

1. Using Both Air Pressure and Vacuum.

NOTE: If vacuum source is available, this method will take less time to perform adjustment. Vacuum source is used to make the exhaust valve lever gap check only.

2. Using Air Pressure Only.

NOTE: When this method is used, it will take longer to perform adjustments as the valve cover must be in place each time air pressure is applied and then removed to permit adjustment of exhaust valve lever.

Instructions covering lever adjustments are identical for front and rear valves, except that portion which describes the actual setting of the levers. On early models, front valve levers are set by screw adjustments but rear valve levers (and front valve levers on late models) must be bent to

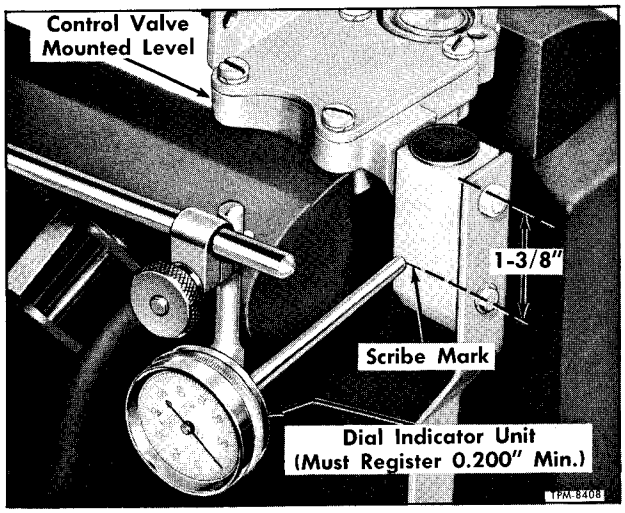


Figure 6—Dial Indicator Properly Installed

proper setting. In these valves both exhaust and intake levers are part of one unit which contains "score" marks to permit easy bending. Mechanics may accomplish this operation with lever in the valve body, or lever may be removed and bent on the bench.

METHOD USING AIR PRESSURE AND VACUUM

1. If air supply and vacuum lines were not connected to valve assembly as directed previously when centering valve overtravel lever, connect lines.

2. Apply air pressure and regulate it to 80 to 110 psi. Apply vacuum and regulate it at approximately 15 inches.

3. Move overtravel lever fore and aft several times and then back to true center position.

4. Starting at true center position, slowly move lever to where air intake valve just begins

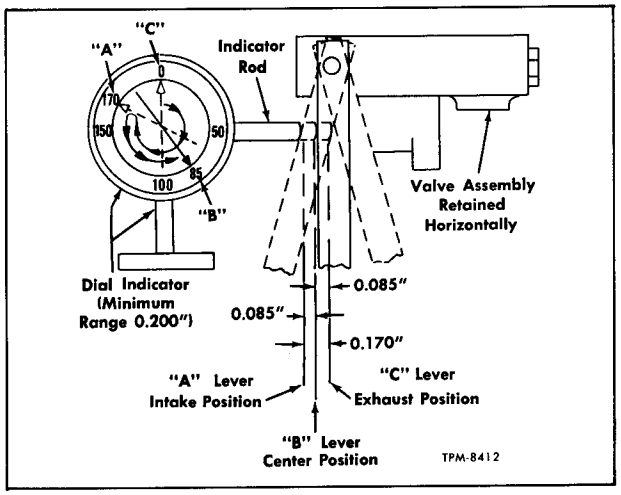


Figure 7—Locating Valve Overtravel Lever Center Position

AIR SUSPENSION

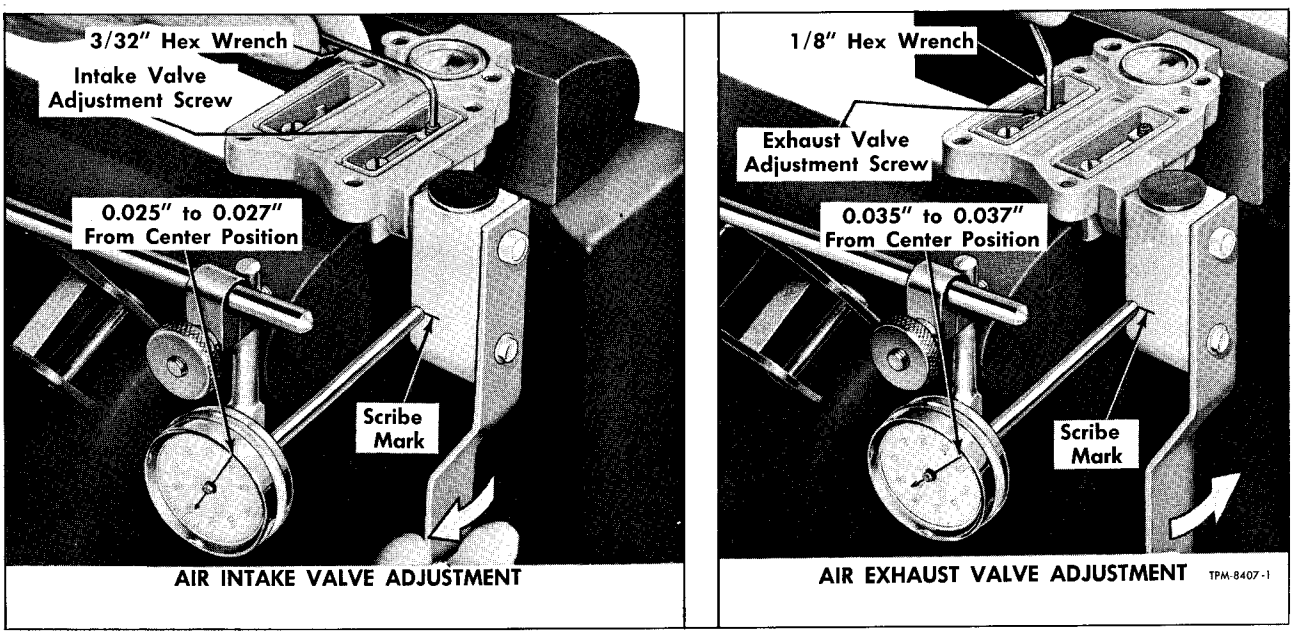


Figure 8—Method of Adjusting Air Valve Lever Gaps

to open. Listen for escaping air. Note reading on dial at this point. Reading should be 0.025" to 0.027" from lever center position. On early front valves, using a 3/32" hex wrench, adjust screw on intake valve lever (left view, fig. 8) until correct setting is obtained. On rear valves, and late model front valves, bend lever to correct setting.

5. Return overtravel lever to center position. Slowly move lever to exhaust side and at same time note the vacuum gauge reading. When vacuum just begins to fall off, the exhaust valve has opened. Valve should open when overtravel lever is moved 0.035" to 0.037" from center position. On early model front valves, using a 1/8-inch hex wrench, adjust exhaust valve lever adjustment screw as shown in right view, figure 8 as required. On rear valves, and late model front valves, bend lever to correct setting.

NOTE: On early model front valves, if the adjustment screw is turned in too tight it must be backed off, and the two arms of exhaust lever spread apart as lever arms are not of the spring-back type. If this action was performed, repeat adjustment procedure above:

6. Recheck intake and exhaust valve lever gaps, then proceed with "Time Delay Check" explained later.

METHOD USING AIR PRESSURE ONLY

NOTE: This method may be performed when a vacuum source is not available.

1. Connect air supply hose (80 to 110 psi) to air inlet port (fig. 5).

2. To adjust air intake valve lever gap:

a. Move the overtravel lever slowly from true center position to point where intake valve just begins to open. Listen for escaping air. Note reading on dial at this point which should register 0.025" to 0.027".

b. On early model front valves using a 3/32" hex wrench adjust screw on intake valve lever (left view, fig. 8) until specified adjustment is obtained. On rear valves, and late model front valves, bend lever to correct setting.

3. To adjust air exhaust valve lever gap:

a. Install valve cover on the valve using the two rubber O-rings (early model front) or gasket (rear and late model front) and four attaching screws.

b. Being careful not to disturb indicator setting, disconnect air supply from the air inlet port and connect it to the bellows port (fig. 5).

c. Move overtravel lever slowly to open exhaust port while observing the indicator dial. Air should start to escape from exhaust port when indicator registers 0.035" to 0.037". If adjustment is necessary, shut off air pressure supply and remove valve cover. On early model front valves, adjust screw setting; on rear valves, and late model front valves, bend to correct setting; then install cover and recheck valve opening dimension.

NOTE: On early model front valves, turning adjustment screw clockwise reduces gap dimension and overtravel lever movement dimension. If the adjustment screw is turned in too tight, it must be backed off, and the two arms of exhaust lever spread apart. If this action was necessary repeat adjustment procedure above.

d. Recheck valve lever gaps, then proceed with "Time Delay Check" following:

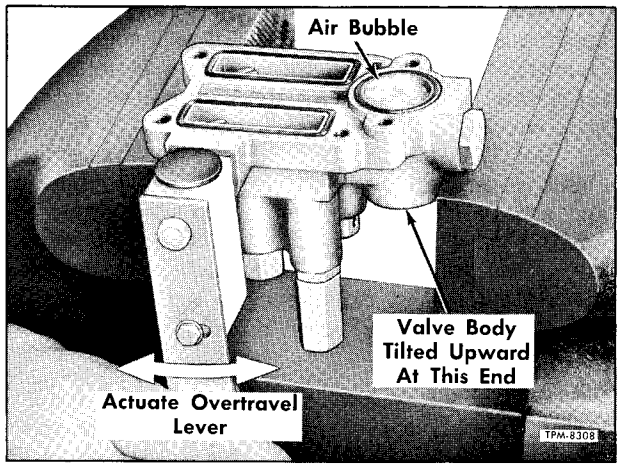


Figure 9—Venting Air from Silicone Fluid

TIME DELAY CHECK

PRELIMINARY PROCEDURES

After the valve lever gaps have been properly adjusted, the time delay check must be performed. A one to six seconds delay from the closing of one valve to the opening of the other is recommended. Also, valves should close from full-open position within one second.

1. Place new O-ring over delay plug, then install plug into valve body. Tighten plug to 20-30 inch-pounds torque.

2. Pour 5.5 cc ± 0.25 cc of Silicone fluid (750 Centistokes viscosity at 25°C) into delay piston bore. With valve body tilted slightly as shown in figure 9 carefully operate overtravel lever fore and aft to vent air from fluid. When all air has been expelled from piston pin cavity, check fluid level using depth gauge as shown in figure 10.

IMPORTANT: With valve assembly level, take measurement from center of bore only. Add or remove fluid to bring fluid 1/8-inch from top of valve body on early model front valve, or 13/64 inch from top on rear valve and late model front valve. An eyedropper will serve for this purpose.

3. Place new delay piston cover O-ring in groove of valve body. Install cover with two attaching screws and tighten to 20-25 inch-pounds torque (early model front). The delay piston on rear valves and late model front valves is held in place with a snap ring.

4. Place valve assembly vertically in holding vise (fig. 11).

5. Cycle arm up and down for approximately one minute.

AIR INLET TIME DELAY CHECK

1. Connect air pressure supply hose to valve air inlet port (fig. 5).

2. Move the overtravel lever upward (quickly) approximately two inches and simultaneously start counting the number of seconds before air starts to escape from bellows port. A delay of one to six seconds should exist. Repeat this check.

AIR EXHAUST TIME DELAY CHECK

To time the delay for exhaust, two methods can be used; one using vacuum source and one using air pressure.

1. Method Using Vacuum

a. Connect vacuum hose to air exhaust port (fig. 5). Adjust vacuum to 15 inches.

b. Move the overtravel lever downward (quickly) approximately two inches and simultaneously start counting the number of seconds before the

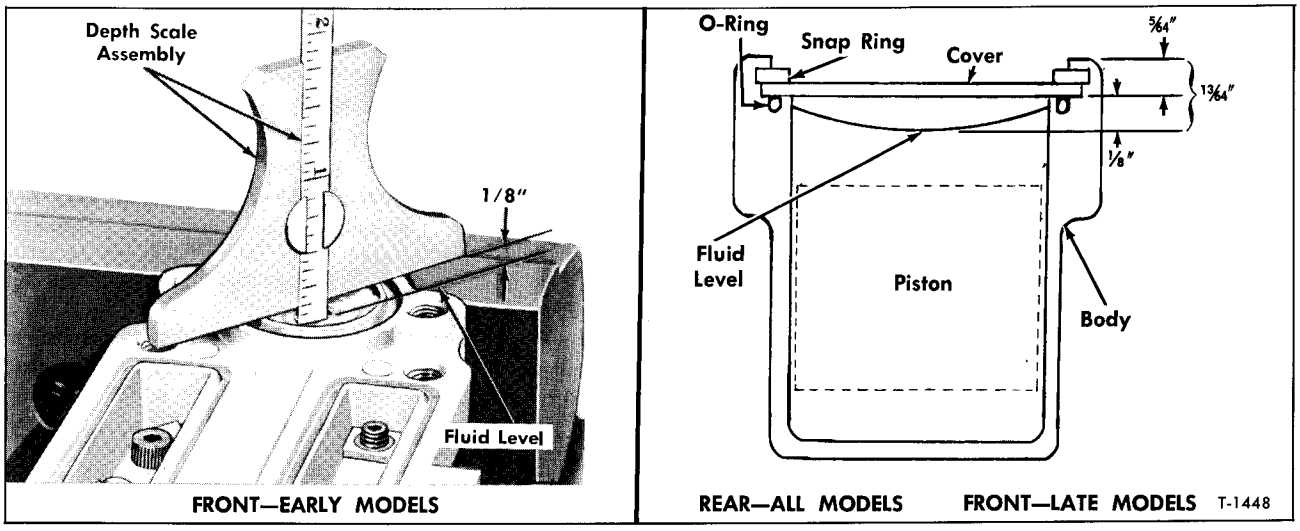


Figure 10—Measuring Fluid Level

AIR SUSPENSION

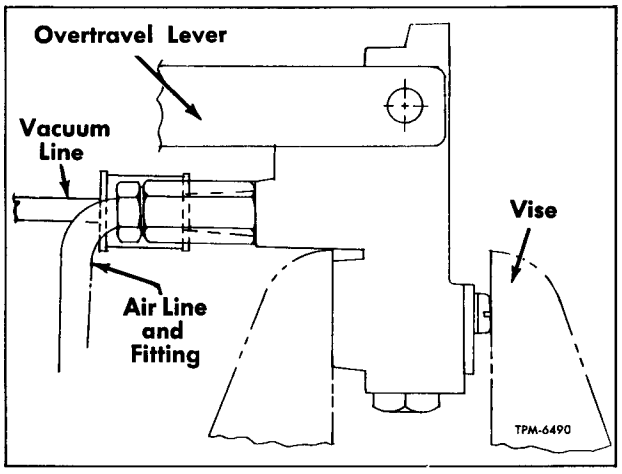


Figure 11—Valve Positioned for Time Delay Check

vacuum gauge starts to drop off. A delay of one to six seconds should exist. Repeat this check.

2. Method Using Air Pressure

a. Install valve cover with rubber O-rings or gasket on valve assembly.

b. Connect air pressure supply hose to bellows port (fig. 5).

c. Move overtravel lever downward (quickly) approximately two inches and simultaneously start counting the seconds before air starts to escape from the exhaust port. A delay of one to six seconds should exist.

IMPORTANT: A time delay over six seconds could mean too large a valve lever gap adjustment and a time delay under one second would mean too small a valve lever gap adjustment. If the time delay is not within one to six seconds, first recheck the fluid level. If fluid level is satisfactory, the valve lever gap adjustment must be repeated, step by step.

NOTE: After obtaining proper valve adjustments, install valve cover using new rubber O-rings (early model front valve) or gasket (rear valves and late model front valve). Install new screen in bellows port, then using new O-ring, install outlet adapter into bellows port. (NOTE: On early model front valves, two outlet adapters, screens, and nylon balls are used.) If screen was removed from exhaust port, install new screen and exhaust fitting. Install air line gaskets.

NOTE: Place tape over ends of air line ports until such time as valve assembly is installed on vehicle.

HEIGHT CONTROL VALVE OVERHAUL

Height control valves meter air into and out of the air suspension system. These valves are precision built and accurately adjusted. Parts must be carefully handled and assembled. Valves must also be accurately adjusted to insure proper operation after rebuild. Special tools mentioned previously should be used. Makeshift tools may break off chips that that could lodge between valve and seats. Chips, dirt, and other foreign material could cause faulty valve operation.

NOTE: Repair parts kit is available which contains all parts usually requiring replacement in average overhaul.

FRONT VALVE (EARLY MODEL)

The following procedures cover the disassembly, cleaning, inspection and assembly of the early model front valve which has two air supply outlets, separate intake and exhaust valve levers and nylon ball check valves. Procedures covering the same operations for rear valves (one air supply outlet, a single unit combined lever and no nylon ball check valves) follow immediately after these instructions.

DISASSEMBLY (Refer to Fig. 12)

1. Remove inlet adapter and check valve assembly (36) from valve body (14). Remove outlet adapters (32), adapter outlet screws (34), and nylon balls (12). Remove adapter O-rings (33). Remove air line fitting gasket (35) from adapters.

2. Remove four cover screws and lock washers (1) from cover and bracket (2). Remove cover and bracket and cover O-rings (3).

3. Position valve with delay plug at top. Unscrew delay plug (37) from valve body. Drain silicone fluid from cavity. Remove plug O-ring (38). Unscrew piston pin (39) from control shaft.

4. Remove two cover screws and lock washers (1) from cover (42). Remove cover and cover O-ring (41). Remove delay piston (40).

5. Remove valve lever screws and lock washers (4) from valve levers. Remove exhaust valve lever (10) and intake valve lever (6) from valve body.

6. Remove valve stem lock clip (7) from stem of exhaust valve core. Spread locking arms and slide clip from around stem.

7. Remove retaining ring (13) from overtravel control shaft. Pull overtravel assembly and shaft from valve body.

8. Remove intake valve core (8) with tool J-6888 as shown in figure 14.

9. Remove exhaust fitting (29) and screen (30), then remove exhaust valve core (31) with tool J-6888 as shown in figure 14.

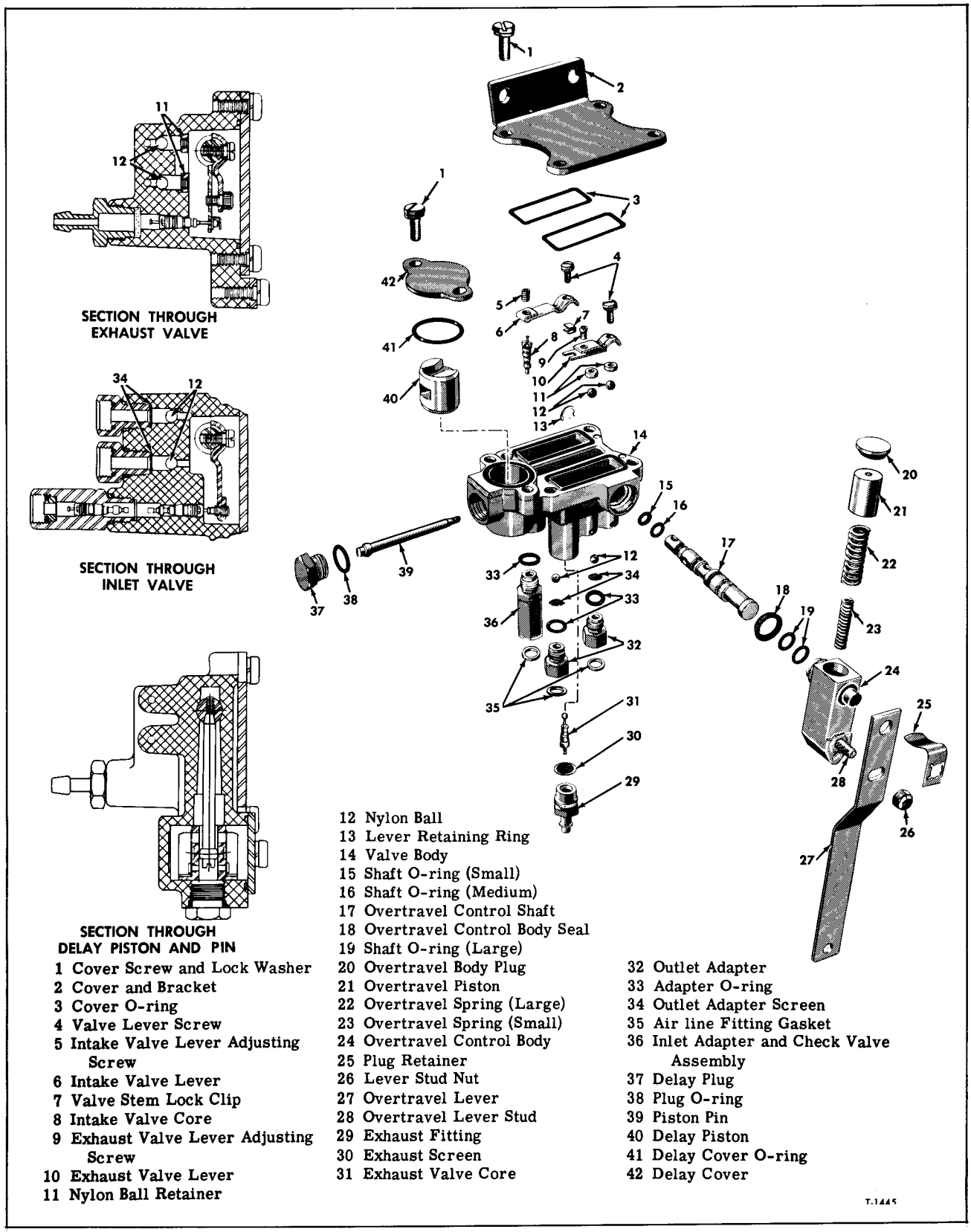
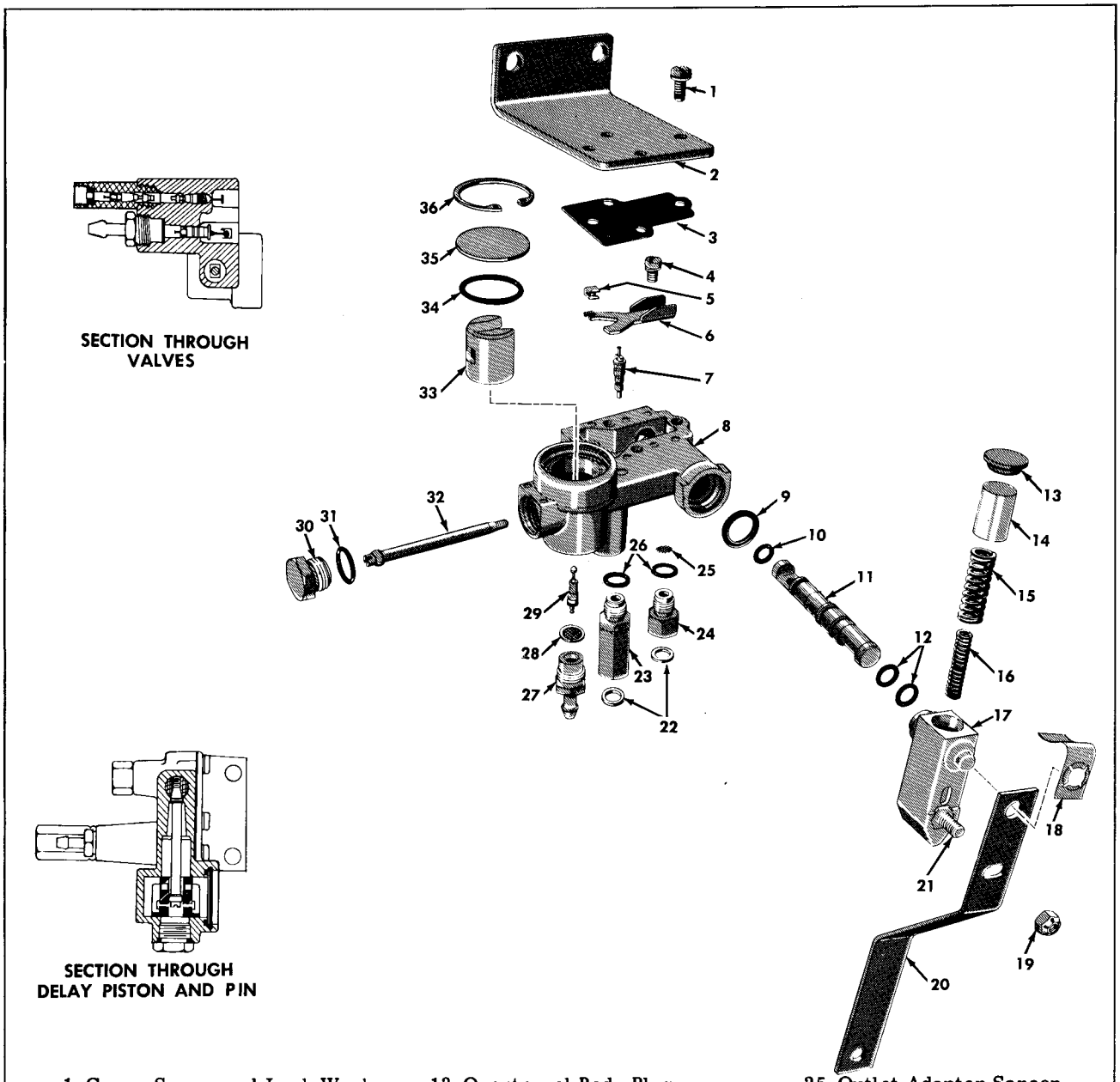


Figure 12—Height Control Valve Components (Front—Early Models)

AIR SUSPENSION



1 Cover Screw and Lock Washer
2 Cover and Bracket
3 Cover Gasket
4 Valve Lever Screw
5 Valve Stem Lock Clip
6 Intake and Exhaust Valve Lever
7 Intake Valve Core
8 Valve Body
9 Overtravel Control Body Seal
10 Shaft O-ring (Medium)
11 Overtravel Control Shaft
12 Shaft O-ring (Large)
13 Overtravel Body Plug
14 Overtravel Piston
15 Overtravel Spring (Large)
16 Overtravel Spring (Small)
17 Overtravel Control Body
18 Plug Retainer
19 Lever Stud Nut
20 Overtravel Lever
21 Overtravel Lever Stud
22 Airline Fitting Gasket
23 Inlet Adapter and Check Valve Assembly
24 Outlet Adapter
25 Outlet Adapter Screen
26 Adapter O-ring
27 Exhaust Fitting
28 Exhaust Screen
29 Exhaust Valve Core
30 Delay Plug
31 Plug O-ring
32 Piston Pin
33 Delay Piston
34 Delay Cover O-ring
35 Delay Cover
36 Delay Cover Retainer

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Figure 13—Height Control Valve Components (Rear—All Models—Front—Late Models)

10. Remove two retainers (11) and nylon balls (12) from exhaust valve lever cavity in body. Threaded end of piston pin (39) can be used to lift ball retainers out of body.

11. Remove plug retainer (25) from overtravel control body (24). Retainer must be cut off. Use caution to avoid damage to nylon body. Remove overtravel body plug (20).

12. Place forked end of tool J-8424 around shaft in overtravel control body, then tighten clamp screw. See figure 15. CAUTION: TIGHTEN TOOL UNTIL OVERTRAVEL CONTROL SHAFT (17) CAN BE TURNED 90° TO ALLOW NOTCH IN SHAFT TO PASS FREE OF OVERTRAVEL PISTON (21). DO NOT APPLY MORE PRESSURE THAN IS REQUIRED. Remove overtravel control shaft (17) and overtravel control body seal (18) from body. Remove shaft O-rings (15, 16, and 19). Back off vise jaw and take body and tool from vise. Remove tool, overtravel piston (21), overtravel lever large spring (22), and overtravel lever small spring (23) from body. Remove lever screw nut (26) from overtravel lever screw or stud. Remove lever (27) from body.

CLEANING AND INSPECTION (Refer to Fig. 12)

1. The following parts should be discarded and replaced with new parts at each overhaul: Plug retainer (25), overtravel control body seal (18), and O-rings (3, 15, 16, 19, 33, 38 and 41).

2. Thoroughly clean all metallic parts in a suitable cleaning solvent. Blow parts dry with compressed air.

3. Inspect all bearing and rubbing surfaces for scoring, fractures, or noticeable wear. Replace all damaged or worn parts with new parts.

ASSEMBLY (Refer to Fig. 12)

CAUTION: HEIGHT CONTROL VALVE PARTS MUST BE KEPT FREE FROM DIRT AND MOISTURE.

1. Install intake valve core (8) and exhaust valve core (31) in body with tool J-6888 in manner shown in figure 14. Tighten to 2-1/2 to 3 inch-pounds torque.

2. On front valves only, place two nylon balls (12) in passages at bottom of exhaust valve lever cavity in body. Install ball retainers (11).

3. Lubricate overtravel body with multi-purpose grease. Assemble overtravel components as follows:

a. Install overtravel lever (27) on body. Place lever stud nut (26) on stud and tighten to 70-80 inch-pounds torque.

b. Place overtravel lever large spring (22), and overtravel lever small spring (23) inside piston (21). Insert piston in body (24).

c. Place four new O-rings (15, 16 and 19) on overtravel control shaft (17) as shown. Lubricate shaft and O-rings with multi-purpose grease.

d. Position fork of tool (J-8424) so that shaft can be inserted in body. Carefully apply pressure with clamp screw (fig. 15). Compress springs only enough to allow shaft to be inserted. Install overtravel control shaft (17). Rotate shaft so that flat is next to piston.

e. Insert overtravel body plug (20) in bore of body. Force new plug retainer (25) in position over nylon pivot and body plug.

f. Place new overtravel control body seal (18) on shoulder of body. Slide overtravel assembly into valve body (14). Insert carefully to avoid O-ring damage. Secure shaft by installing retaining ring (13).

4. Install delay assembly as follows:

a. Place delay piston (40) in valve body with open side of piston toward the overtravel shaft.

b. Align pin openings in piston and in shaft. Fit piston pin (39) in TAPERED SIDE of hole in shaft. Tighten pin to 8-10 inch-pounds torque.

5. Place intake valve lever (6) and exhaust valve lever (10) in position on overtravel shaft. Place exhaust valve lever fork around stem of valve core. Fork should be high enough on stem so that stem will not be held open. Insert valve lever screws (4) and lock washers and tighten to 8-10 inch-pounds torque.

6. Spread ends of valve stem lock clip (7) slightly and place on exhaust valve stem around stem head. Use suitable tool to brace stem, and pinch ends of clip just enough to secure on stem. Clip must rotate freely on stem.

7. Using new O-ring (33), install air inlet adapter and check valve assembly (36) into valve body.

8. At this stage of assembly, make all of the valve assembly adjustments as explained previously under "Height Control Valve Adjustments."

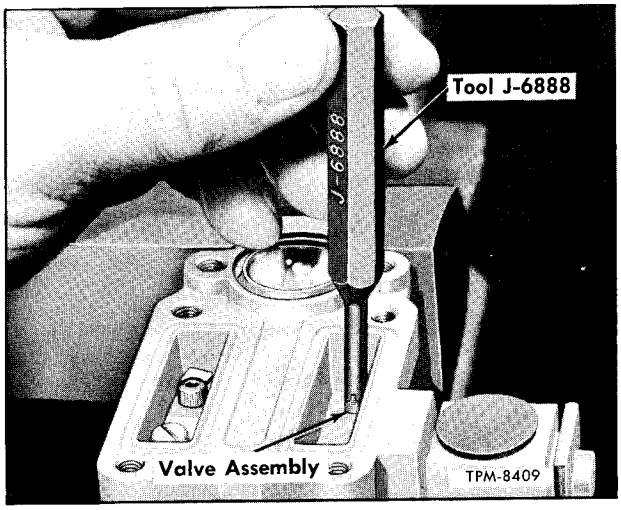


Figure 14—Replacing Valve Core Assemblies

REAR VALVE—ALL MODELS (AND FRONT VALVE, LATE MODELS)

The following procedures cover disassembly, cleaning, inspection and assembly of the valves used at rear of all coaches and those used at the front on late model coaches. The differences between these valves and early model front valves has been explained previously.

DISASSEMBLY (Refer to Fig. 13)

1. Remove inlet adapter and check valve assembly (23) from valve body (8). Remove outlet adapter (24). Remove adapter O-rings (26). Remove air line fitting gasket (22) from adapters. Remove outlet adapter screen (25).

2. Remove four cover screws and lock washers (1) from cover and bracket (2). Remove cover and bracket and gasket (3).

3. Position valve with delay plug at top. Unscrew delay plug (30) from valve body. Drain silicone fluid from cavity. Remove plug O-ring (31). Unscrew piston pin (32) from control shaft.

4. Remove delay cover retainer (36), cover (35) and cover O-ring (34). Remove delay piston (33).

5. Remove valve lever screw and lock washer (4) from valve lever. Remove exhaust valve and intake valve lever (6) from valve body. Both levers (6) are one unit.

6. Remove valve stem lock clip (5) from stem of exhaust valve core. Spread locking arms and slide clip from around stem.

7. Pull overtravel assembly and shaft from valve body.

8. Remove intake valve core (7) with tool J-6888 as shown in figure 14.

9. Remove exhaust fitting (27) and screen (28), then remove exhaust valve core (29) with tool J-6888 as shown in figure 14.

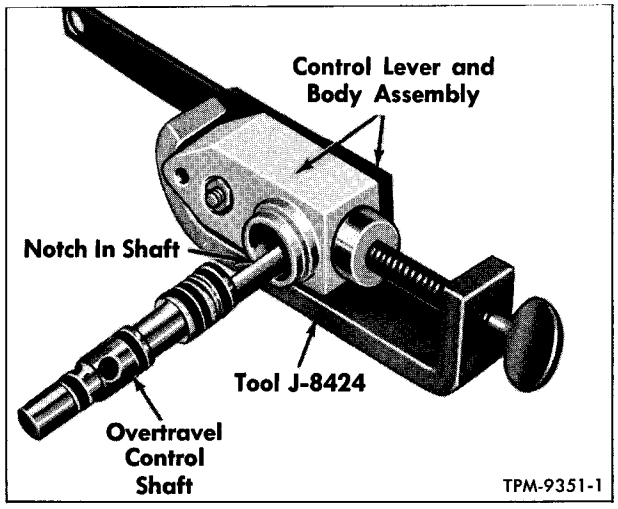


Figure 15—Replacing Overtravel Lever

10. Remove plug retainer (18) from overtravel control body (17). Retainer must be cut off. Use caution to avoid damage to nylon body. Remove overtravel body plug (13).

11. Place forked end of tool J-8424 around shaft in overtravel control body, then tighten clamp screw. See figure 15.

CAUTION: TIGHTEN TOOL UNTIL OVERTRAVEL CONTROL SHAFT (11) CAN BE TURNED 90° TO ALLOW NOTCH IN SHAFT TO PASS FREE OF OVERTRAVEL PISTON (14). DO NOT APPLY MORE PRESSURE THAN IS REQUIRED. Remove overtravel control shaft (11) and overtravel control body seal (9) from body. Remove shaft O-rings (10 and 12). Back off vise jaw and take body and tool from vise. Remove tool, overtravel piston (14), overtravel lever large spring (15), and overtravel lever small spring (16) from body. Remove lever screw nut (19) from overtravel lever screw or stud. Remove lever (20) from body.

CLEANING AND INSPECTION

1. The following parts should be discarded and replaced with new parts at each overhaul: Plug retainer (18), overtravel control body seal (9), gasket (3), and O-rings (10, 12, 26, 31 and 34).

2. Thoroughly clean all metallic parts in a suitable cleaning solvent. Blow parts dry with compressed air.

3. Inspect all bearing and rubbing surfaces for scoring, fractures, or noticeable wear. Discard all damaged or worn parts and replace with new parts.

ASSEMBLY

CAUTION: HEIGHT CONTROL VALVE PARTS MUST BE KEPT FREE FROM DIRT AND MOISTURE.

1. Install intake valve core (7) and exhaust valve core (29) in body with tool J-6888 in manner shown in figure 14. Tighten to 2-1/2 to 3 inch-pounds torque.

2. Lubricate overtravel body with multi-purpose grease. Assemble overtravel components as follows:

a. Install overtravel lever (20) on body. Place lever stud nut (19) on stud and tighten to 70-80 inch-pounds torue.

b. Place overtravel lever large spring (15), and overtravel lever small spring (16) inside piston (14). Insert piston in body (17).

c. Place three new O-rings (10 and 12) on overtravel control shaft (11). Lubricate shaft and O-rings with multi-purpose grease.

d. Position fork of tool (J-8424) so that shaft can be inserted in body. Carefully apply pressure with clamp screw (fig. 15). Compress springs only enough to allow shaft to be inserted. Install overtravel control shaft (11). Rotate shaft so that flat

is next to piston.

e. Insert overtravel body plug (13) in bore of body. Force new plug retainer (18) in position over nylon pivot and body plug.

f. Place new overtravel control body seal (9) on shoulder of body. Slide overtravel assembly into valve body (8). Insert carefully to avoid O-ring damage.

3. Install delay assembly as follows:

a. Place delay piston (33) in valve body with open side of piston toward the overtravel shaft.

b. Align pin openings in piston and in shaft. Fit piston pin (32) in TAPERED SIDE of hole in shaft. Tighten pin to 8-10 inch-pounds torque.

4. Place intake valve and exhaust valve lever (6) in position on overtravel shaft. Make sure the fork on the exhaust lever side is around stem of exhaust valve core. Fork should be high enough on stem so that stem will not be held open. Insert valve lever screw (4) and tighten to 8-10 inch-pounds torque.

5. Spread ends of valve stem lock clip (5) slightly and place on exhaust valve stem around stem head. Use suitable tool to brace stem and pinch ends of clip just enough to secure on stem Clip must rotate freely on stem.

6. Using new O-ring (26), install air inlet adapter and check valve assembly (23) into valve body.

7. Make all of the valve assembly adjustments explained under "Height Control Valve Adjustments" on pages 58 through 62.

TROUBLESHOOTING HEIGHT CONTROL VALVE

MALFUNCTION	POSSIBLE CAUSE	CORRECTIVE MEASURE
1. Bellows deflate overnight.	a. Defective check valve assembly.	a. Replace check valve assembly.
	b. Defective exhaust valve assembly.	b. Replace exhaust valve assembly.
	c. Leak in air line and/or bellows.	c. Replace air line or bellows.
	d. Defective valve cover rubber O-rings or gasket.	d. Replace valve cover O-rings or gasket.
2. Bellows raise to full height and fail to exhaust air pressure.	a. A clogged exhaust screen in height control valve assembly.	a. Remove, then clean screen.
	b. A combination clogged exhaust screen and a defective air inlet valve assembly.	b. Clean exhaust screen and replace air inlet valve assembly.
3. Intermittent hissing noise at height control valve during operation.	a. Loss of time delay action fluid in height control valve assembly.	a. Add fluid, then install new cover and delay piston plug gasket O-rings.
4. Erratic valve action.	a. Dirt or foreign matter in the air valve lever chamber.	a. Remove valve cover and blow out dirt. Install cover using new rubber O-rings.
	b. Defective valves.	b. Overhaul height control valve assembly.
5. Vehicle body fails to level out.	a. Improper height control valve overtravel lever adjustment.	a. Make proper adjustments as directed previously under "Ride Height Check and Adjustment."

Use Only Approved Silicone Fluid in Height Control Valves. Refer to Parts Books or Serving Zone Warehouse for Correct Material.

When repairing height control valves, cleanliness is of the utmost importance. A very small particle of foreign material in a valve will contaminate it and result in malfunction.

Power Steering

The power steering system provides automatic hydraulic assistance to the turning effort applied to the mechanical steering system. The power steering is adaptable to the standard mechanical steering with a minimum amount of alterations.

The power steering system consists primarily of three units, used in conjunction with the conventional steering gear:

1. Control Valve.
2. Booster Cylinder.
3. Hydraulic Pump.

OPERATION

Power steering is accomplished through use of hydraulic pressure. This pressure is supplied by a vane-type oil pump mounted at left rear of the engine. The pump is driven through a coupling by engine blower drive shaft. Pressure created by the pump is circulated through flexible fluid lines to a self-contained actuating booster cylinder installed on the front axle (fig. 1). Movement of steering wheel is transmitted through conventional Pitman arm and drag link to a control valve located in booster cylinder. This control valve directs hydraulic fluid, under pressure created by the hydraulic pump, to either side of a piston in the booster cylinder, producing movement of piston and attached drag link of the coach steering linkage. Force applied by booster cylinder to drag link is automatically the amount of thrust necessary for all steering requirements.

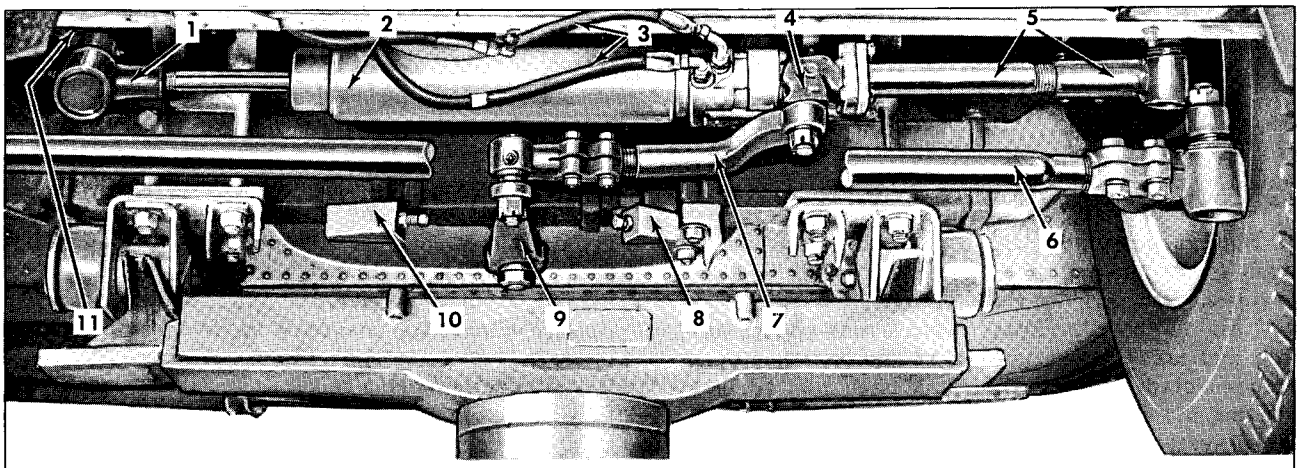
MAINTENANCE

The power steering hydraulic system requires little maintenance. However, the system should be kept clean to insure maximum operating performance and trouble-free service. Periodic inspection to check for leaks should also be made.

At regular intervals the hydraulic fluid level in pump reservoir should be checked and fluid added when required. The fluid to be used must be an "Automatic Fluid - Type A" supplied in containers bearing mark "AQ-ATF," followed by an identification number and letter "A." DO NOT USE ANY OTHER FLUID.

After thoroughly cleaning around cover, remove filler cap and dipstick from cover. Wipe dipstick with clean cloth, then recheck fluid level. Replenish fluid if necessary to bring level up to "FULL" mark on dipstick. Be sure that fluid being added is clean, also that screen inside reservoir is not damaged if funnel is used.

The fluid reservoir and filter assembly is mounted in the upper right-hand corner of the engine compartment (fig. 2). When the slightest evidence of dirt, sludge, or water is discovered in the system, drain and refill with clean recommended hydraulic fluid. To drain system, disconnect

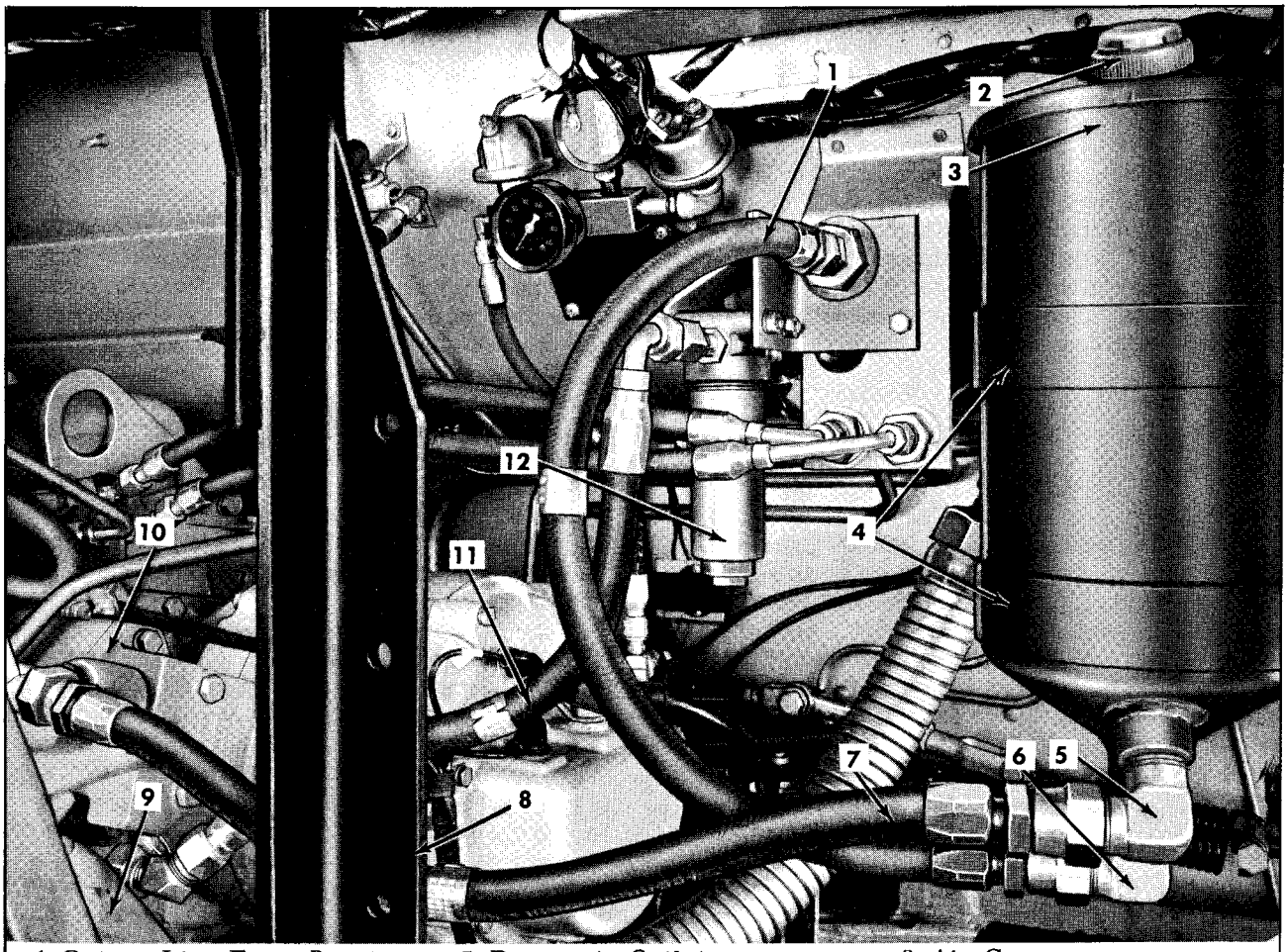


1 Piston Rod Socket Assembly
2 Booster Cylinder Assembly
3 Pressure and Return Line Hoses
4 Booster Cylinder Ball Stud
5 Extension and End Socket Assembly
6 Steering Tie Rod
7 Drag Link Assembly
8 Pitman Arm Right-Hand Stop
9 Pitman Arm
10 Pitman Arm Left-Hand Stop
11 Piston Rod Socket End Support

T-579-1

Figure 1—Power Steering Booster Cylinder Installed

POWER STEERING



1 Return Line From Booster	5 Reservoir Outlet	9 Air Compressor
2 Filler Cap Assembly	6 Reservoir Inlet	10 Hydraulic Pump
3 Reservoir Shell Assembly	7 Return Line to Pump	11 Pressure Line to Booster
4 Support Clamps	8 Engine Support Hanger	12 Fluid Line Filter T-1229

Figure 2—Power Steering Pump, Filter, and Reservoir Installed

fluid lines at booster cylinder.

Power steering fluid filters should be serviced at regular lubrication intervals. Refer to instructions under heading of "Power Steering Fluid Reservoir and Filters" in this section.

Air in the fluid system will cause spongy action and noisy operation. When any hose has been disconnected or when fluid has been lost for any reason, the system must be bled after adding fluid. Bleed system as directed later in this section under "Bleeding Power Steering Hydraulic System." Should the power steering system become inoperative because of loss of hydraulic fluid, pump pressure line should be re-routed from pump outlet directly back to pump reservoir.

IMPORTANT: Do not operate pump without fluid in the pump reservoir.

If steering linkage between steering gear and front wheels is out of adjustment, bent, twisted, or worn, steering action of coach will be seriously affected. At any time steering linkage parts are repaired, replaced, or adjusted, steering geometry and front wheel alignment must be checked.

At regular lubrication intervals, the steering linkage should be checked completely for worn or loose ball stud end sockets.

If coach steering tends to wander in one direction, after making certain that front end is properly aligned, cause may be that the control valve in booster cylinder may not be centering properly.

BLEEDING POWER STEERING HYDRAULIC SYSTEM

When power steering hydraulic pump, booster cylinder assembly, or fluid reservoir and filter assembly has been removed for overhaul or replacement, or any hydraulic system lines discon-

nected, the hydraulic system must be bled before vehicle is again operated. Bleed power steering hydraulic system as follows:

NOTE: When hydraulic fluid is added to power steering system, fluid should be poured through a 200 mesh wire screen secured inside funnel. Use only the hydraulic fluid recommended in the power steering hydraulic system.

1. Fill power steering pump reservoir tank to "FULL" mark on dipstick. Let hydraulic fluid remain undisturbed for about two or three minutes.
2. Raise front end of coach until front wheels are well off floor.
3. Eliminate air pockets in booster cylinder and hydraulic system by turning front wheels to right and left Pitman arm stops. Continue this procedure, while maintaining fluid level in pump reservoir tank to "FULL" mark on dipstick, until fluid in pump tank stops bubbling.
4. Start engine and run at idle for two or three minutes. Turn front wheels to right and left as before. DO NOT HIT WHEEL STOPS. Maintain fluid level in pump reservoir tank to "FULL" mark on dipstick. Check system lines and connections for leaks. Continue these procedures until fluid in pump reservoir tank is clear and free of bubbles.
5. Increase engine speed to approximately half throttle and run engine at this speed until all signs of air bubbles cease to exist in pump reservoir tank. Turn wheels to right and left as before. DO NOT HIT PITMAN ARM STOPS.
6. Lower coach to floor and turn wheels to right and left while rechecking for fluid leaks.
7. Recheck fluid level in pump reservoir tank and fill to "FULL" mark on dipstick.

HYDRAULIC PRESSURE TEST

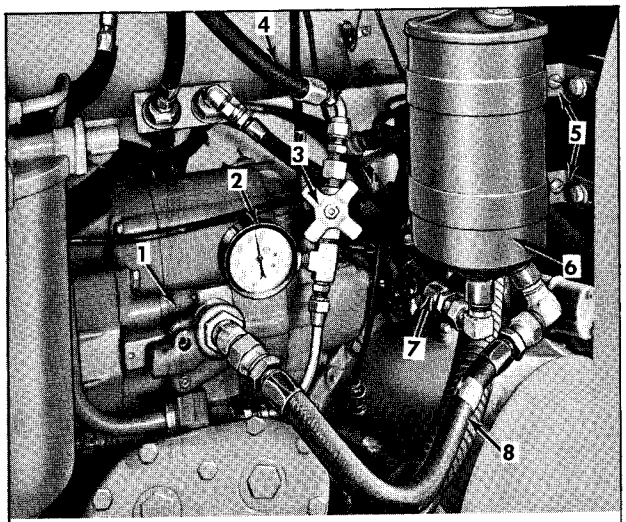
1. Disconnect pressure hose from fitting at the hydraulic pump.

NOTE: Some hydraulic fluid will leak out when line is disconnected. Provision should be made to catch this fluid.

2. Connect pressure checking gauge (J-5631-01) (fig. 3) between the pump pressure port and pressure hose. Leave valve in pressure gauge open.
3. Bleed steering hydraulic system to remove all air from pressure line as directed previously under "Bleeding Hydraulic System."
4. Start engine and run at idle speed. Turn wheels through normal operating range several times until the hydraulic fluid temperature reaches 170°F. When fluid temperature reaches 170°F., close valve in pressure gauge line and observe reading on pressure gauge. Pressure reading should be 1000 psi (± 50 psi).

IMPORTANT: Do not leave valve closed for more than 15 seconds.

5. Open valve in pressure gauge line. Turn wheels to extreme right and left against "stops" (with wheels on ground). At extreme right or left position the maximum pressure reading should be within the amount specified in procedure 4 above.
6. If pump pressure is less than amount specified, make necessary repairs described under "Hydraulic Pump Overhaul" later in this section.
7. If pump pressure is satisfactory, shut off the engine and remove pressure checking gauge.
8. Reconnect pressure hose to pump port fitting; then bleed hydraulic system as described previously under "Bleeding Power Steering Hydraulic System."



1 Hydraulic Pump
2 Pressure Checking Gauge
3 Gauge Valve
4 Pressure Line
5 Support Clamps
6 Reservoir and Filter Assembly
7 Inlet Line
8 Outlet Line
T-582

Figure 3—Checking Pump Hydraulic Pressure (Typical)

POWER STEERING BOOSTER CYLINDER

GENERAL

The cutaway view in figure 4 illustrates the assembly and construction of the valve assembly with ball stud, the integral steering unit and the cylinder assembly. The control valve is bolted to the cylinder. Fluid flow from the pump is directed by the valve through internal ports into the cylinder to operate the piston.

The rod end of the steering cylinder piston is anchored to the vehicle. The cylinder and valve body are connected to the wheels through the extension and end socket assembly and the valve is linked to the steering gear by the drag link assem-

POWER STEERING

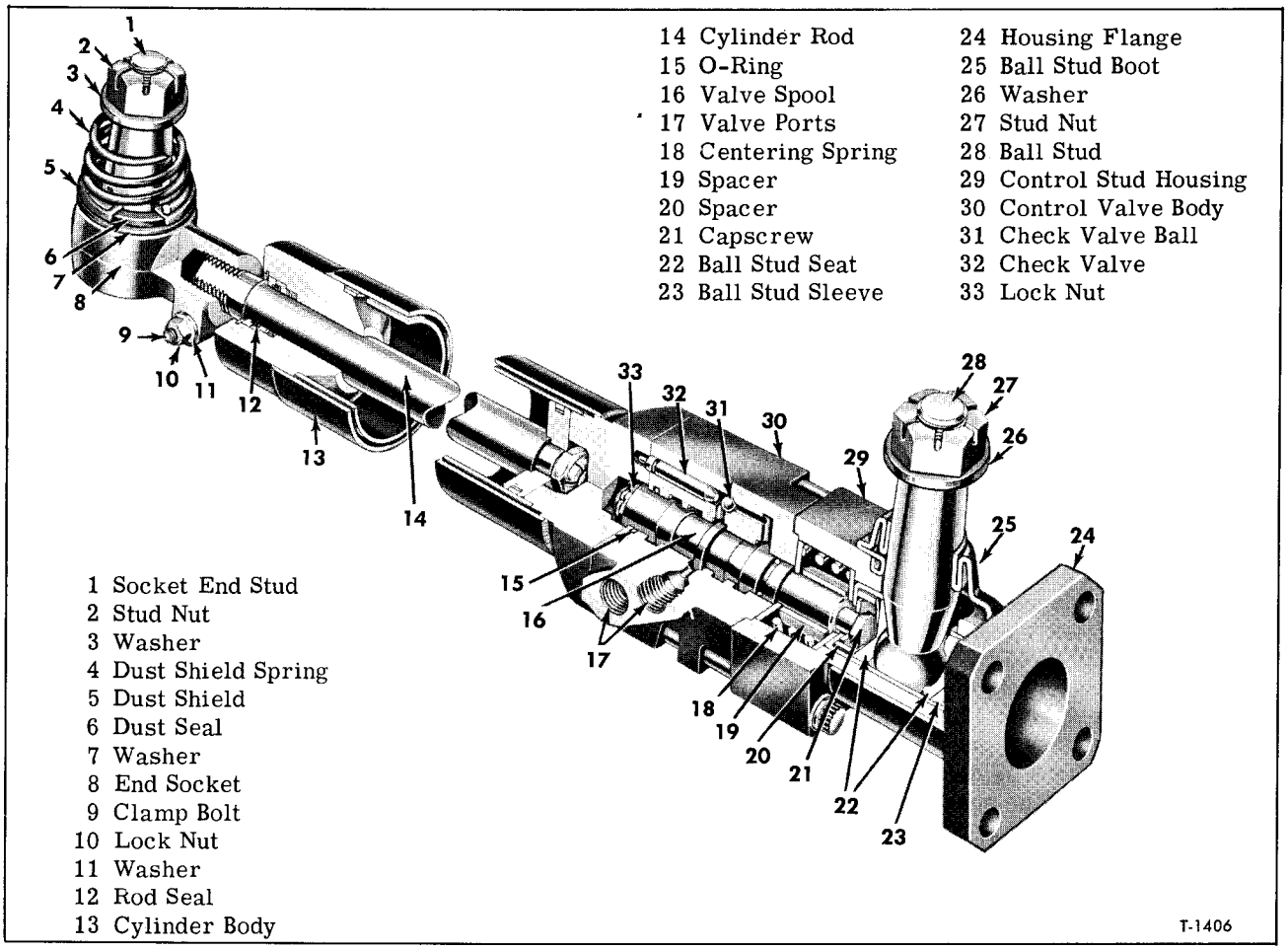


Figure 4—Power Steering Booster Cylinder Assembly

bly. Road shock forces on the wheels tend to move the cylinder, but this action also moves the valve body in relation to the spool, which is being held by the drag link. Movement of the valve body relative to the valve spool directs oil to the cylinder to compensate for the road shock loads and to maintain vehicle directional control at the steering wheel.

When the valve spool is moved in either direction by movement of the steering wheel and drag link, oil is directed to the cylinder. This causes the cylinder and valve body to move in the desired direction relative to the piston and rod which is anchored to the vehicle. Movement of the cylinder and valve body, which, through the extension and end socket assembly, are connected to the wheels, steers the vehicle.

OPERATION

(Refer to Figure 5)

Neutral Position - Neutral position is obtained when free hydraulic flow from the valve inlet to outlet is provided by the position of the control spool in relation to internal passages.

Extend or Retract - Movement of the steering wheel in either direction is transmitted through mechanical linkage to the control valve ball stud. Movement of the ball stud causes movement of the control spool. Pump oil flow is directed by spool position to either the head end or rod end of the cylinder, causing the cylinder to extend or retract. Movement of the cylinder will continue as long as the control spool is offset by continued turning of the steering wheel. When the steering wheel stops turning, the control spool stops and the cylinder and valve body move to center (Neutral) position and stop. This is true in any position of the steering wheel if steering Pitman arm stops are provided to prevent the cylinder from bottoming with the wheels against the wheel stops.

Pressure - In the event of power source failure, the ball check in the steering control valve body will permit free flow of oil throughout the steering unit. This permits the steering system to be operated manually.

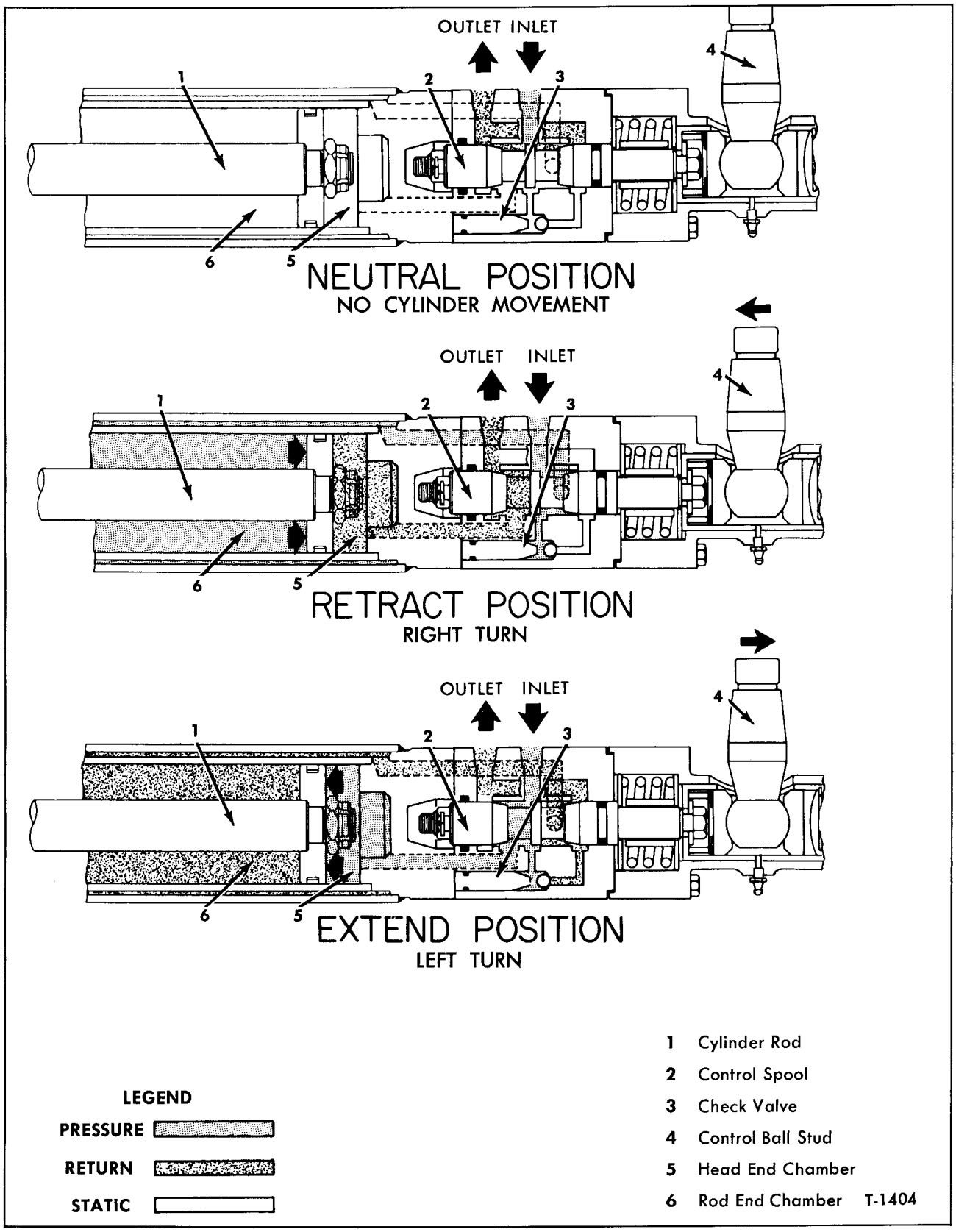


Figure 5—Operational Diagrams of Steering Booster Cylinder

POWER STEERING

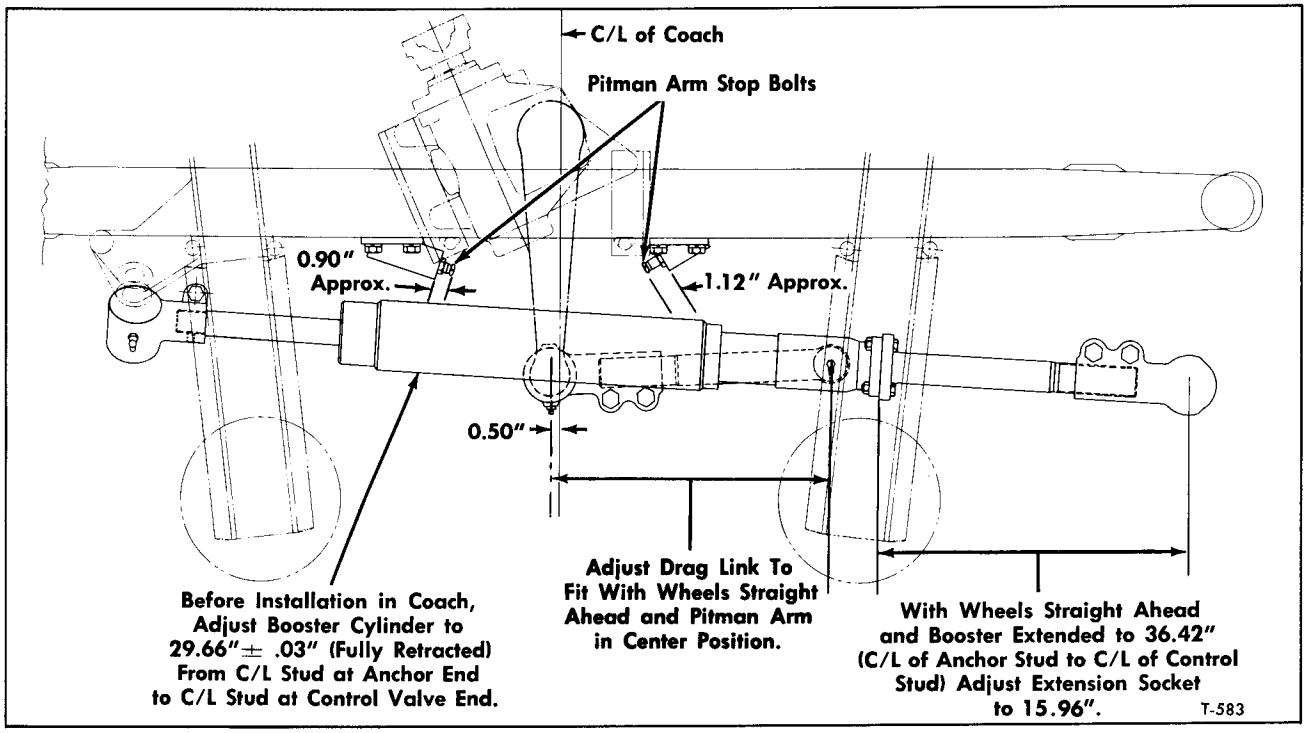


Figure 6—Power Steering Booster Cylinder Installation

Malfunction - For diagnosis and remedy of trouble relative to power steering booster assembly, see "Booster Cylinder Trouble Shooting Chart" in this section.

BOOSTER CYLINDER REPLACEMENT

Power steering booster cylinder assembly, installed as shown in figure 1, can be readily removed from coach at any time service is required that necessitates disassembly or partial disassembly of the unit. Remove booster cylinder assembly from coach as described in the following text. When reinstalling booster cylinder assembly, be sure to accomplish adjustment procedures outlined.

REMOVAL

Key numbers in text refer to figure 1.

1. Attach identification tags to flexible pressure and return hoses (3), then remove hoses and drain fluid from hoses and cylinder.

2. Remove cotter pin and stud nut attaching adjustable steering drag link (7) to booster cylinder ball stud (4). Discard cotter pin.

3. Remove cotter pin and stud nut attaching piston rod end socket tapered stud (1) to piston rod socket end support (11). Discard cotter pin.

4. Remove four cotter pins, nuts, and bolts attaching flange of booster cylinder ball stud body (4) to flange of adjustable extension (5).

5. Remove booster cylinder assembly (2) from drag link end (7) and Pitman rod socket end support (11). It may be necessary to use a suitable puller to aid in removal.

6. Remove dust cover spring and dust cover from booster cylinder ball stud (4).

7. Remove dust cover spring, shield, dust cover, and washer from piston rod end socket tapered stud (1).

8. If necessary, remove set screw and clamp bolt; then turn piston rod end socket (1) off piston rod.

INSTALLATION

Refer to figures 1 and 6; key numbers refer to figure 1.

1. Before installing booster cylinder (2) assembly in coach, compress booster cylinder into fully retracted position; then thread piston rod end socket assembly (1) on booster cylinder piston rod to the dimension shown in figure 6, measured from centerline of socket end tapered stud (1) to centerline of booster cylinder ball stud (4).

2. Position dust cover and dust cover spring on booster cylinder ball stud (4).

3. Position washer, dust cover, shield, and dust cover spring on piston rod end socket tapered stud (1).

4. Check length of cylinder extension and end socket assembly (5), measuring from center of end socket ball stud to flange of extension (fig. 6). Distance should measure 15.96". Adjust as necessary to obtain this dimension.

5. Set wheels in straight ahead position and extend booster cylinder to 36.42" (measure from C/L of piston rod end socket stud (1) to C/L of cylinder ball stud (4).

6. At this stage of installation the booster cylinder (2) should be suspended horizontally under coach and fluid lines (3) connected to unit.

7. Position booster cylinder ball stud body flange (4) to flange of end socket extension (5), at the same time inserting booster cylinder ball stud (4) in hole at end of drag link (7) and piston rod end socket tapered stud (1) into hole in piston rod socket end support (11).

NOTE: Cylinder ball stud to drag link must be positioned at bottom of cylinder. When booster cylinder and end socket extension are pre-set to above dimensions, the studs (1 and 4) should slip easily into the holes in drag link (7) and support (11). Turn adjustable drag link for further adjustment if necessary.

> CAUTION: If excessive adjustment is necessary, after pre-setting to above dimensions, this is an indication that something else is wrong. Check for bent steering arm, misaligned front end or worn components of steering linkage.

8. Dip threads of extension bolts in grease containing zinc oxide (#3); then attach booster cylinder ball stud body flange (4) to flange of end socket extension (5) with four bolts and lock nuts. Tighten bolts to 40-50 foot-pounds torque; then advance lock nuts to nearest cotter pin holes and install new cotter pins.

9. With booster cylinder ball stud inserted through hole at end of drag link, install stud nut on ball stud. Tighten stud nut to 150 foot-pounds torque; then advance nut to nearest cotter pin hole and install new cotter pin.

10. With piston rod end socket tapered stud (1) inserted through hole in support (11), install stud nut on tapered stud. Tighten nut to 150 foot-pounds torque; then advance nut to nearest cotter pin hole and install new cotter pin to retain nut.

IMPORTANT: It is important that the following adjustments be checked.

11. Check position of Pitman arm. With front wheels and steering wheel in straight-ahead position, centerline of hole at drag link end of arm should be 0.50" to left of centerline of coach, when viewed from the rear.

NOTE: Centerline of coach can be identified by prick punch marks on back of front axle beam.

12. If Pitman arm (9) is incorrectly positioned, disconnect drag link (7) from Pitman arm. Loosen clamp bolt securing end socket to drag link. With Pitman arm positioned as described in Step 11, and front wheels and steering wheel in straight-ahead position, turn end socket on drag link as required to align center of end stud with center of hole in Pitman arm. Attach end socket to Pitman arm. Tighten stud nut to 150 foot-pounds torque. Install new cotter pin.

IMPORTANT: Booster cylinder end of drag link must be tilted to same plane as flange of booster cylinder ball stud body before clamp bolt at Pitman arm end socket is tightened. Rotate link if necessary; then tighten bolt to 45-55 foot-pounds torque.

13. Refill power steering hydraulic system and bleed system as directed previously under "Bleeding Power Steering Hydraulic System."

BOOSTER CYLINDER OVERHAUL

DISASSEMBLY

Key numbers in text refer to figure 7.

NOTE: If ball stud housing (41), valve body (25) and cylinder tube (17) have not been scribed with alignment marks, use prick punch and mark these parts so they can be reassembled in same relative position.

> **CAUTION**
>
> Before removing unit or parts of unit to be serviced be certain the unit is not subject to hydraulic pressure.

Do not disassemble a unit further than is necessary to correct a malfunction. During disassembly, special attention should be given to identification of parts for proper reassembly. Place all disassembled parts on a clean, lint-free surface for inspection. Carefully remove any burrs by light stoning. Clean all parts except O-rings and seals in a clean mineral oil solvent. After drying thoroughly, lay the parts on a clean, lint-free surface. All internal oil passages of the unit must be thoroughly cleaned.

> **CAUTION**
>
> Never use an air hose on or near the exposed parts because of the presence of water and dirt in the air system.

All O-rings and seals should be replaced for reassembly. Soak them in hydraulic fluid prior to being used.

Control Valve Disassembly

1. Loosen and remove four stud nuts (43) that secure the control ball stud housing (41) and valve assembly to the cylinder. Remove the control ball stud housing and valve assembly from the cylinder.

POWER STEERING

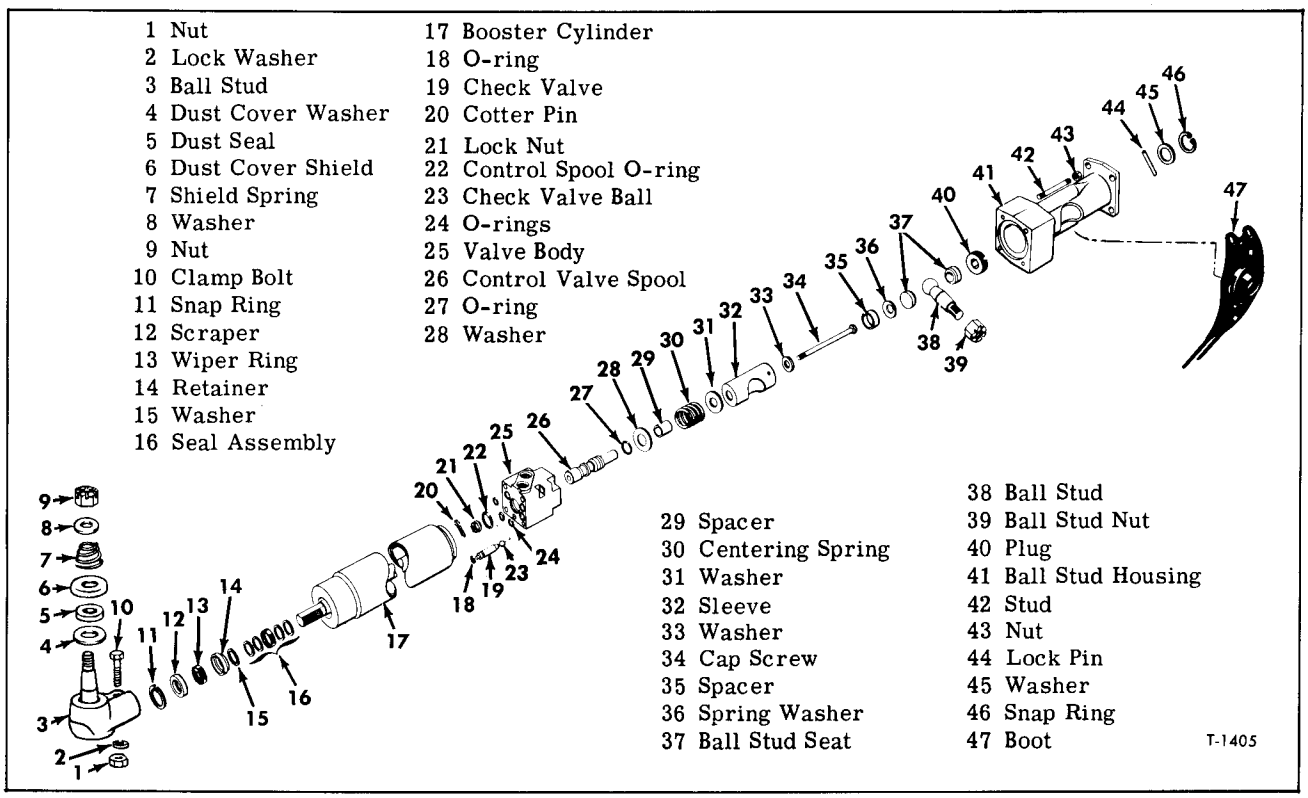


Figure 7—Power Steering Booster Cylinder Components

Remove three O-rings (24) from recesses in the valve body (25). Care must be taken not to score or otherwise damage the cylinder or valve body mating surfaces.

2. Hold control ball stud housing and valve body assembly in a vise, by lightly clamping valve body (25). Use care not to distort spool bore in valve body. Remove snap ring (46) and washer (45). Remove the lock pin (44) which secures the control ball stud sleeve plug (40) and remove plug. Remove control ball stud (38), two ball stud seats (37), spring washer (36) and spacer (35).

3. Remove cotter pin (20) and self-locking nut (21) from cap screw (34). Remove cap screw (34), washer (33) and control ball stud sleeve (32). Then lift the two centering spring retaining washers (31 and 28), centering spring (30) and spacer (29) from the valve body (25). Remove control spool (26) from the control ball stud end of valve body (25). Remove O-ring (27) from valve body and from spool to complete disassembly.

NOTE: The check valve retaining plug with integral valve body-cylinder locating pin should be removed for inspection of valve (19) and ball (23).

Cylinder Disassembly

The cylinder assembly is a sealed unit. Overhaul procedures are restricted to replacing the sealing parts on the rod end.

1. Remove rod end ball stud (3) by removing nut (1), bolt (10), and lock washer (2) from the ball stud housing and unscrewing the ball stud (3).

2. Remove retainer snap ring (11) with snap ring pliers. Rotate the rod and withdraw it far enough from the cylinder to expose scraper (12), wiper ring (13), retainer (14) and washer (15). The shaft seal assembly (16) may be removed with a hooked scriber.

INSPECTION

1. Discard all seals, wipers, and scrapers and replace with new upon reassembly. Wash all parts in a good grade of mineral spirits.

2. Inspect all fluid passages in valve body and cylinder to be certain they are clean and free from obstructions.

3. Check each disassembled part for excessive wear, cracks or pitting that would render them unfit for continued use. Replace all defective parts.

4. Inspect valve spool for deep scoring and excessive wear. Check valve spool bore for similar scoring or pitting. Replace these parts if badly damaged or worn. Do not rework or attempt to "touch-up" the valve spool. This practice will only result in improper steering unit operation and performance.

5. Inspect cylinder shaft for damage and straightness to insure proper seating.

ASSEMBLY

NOTE: Immerse all parts in clean hydraulic fluid to facilitate reassembly.

Seals - Be sure that all old seals, wipers and scrapers are discarded and replaced with new parts for reassembly. Remember that a seal can only do its job when properly seated to prevent fluid leakage and entrance of air into the system. Coat all seals with liberal amounts of grease or petroleum jelly prior to assembly.

Control Valve Assembly

1. Install new O-rings (22 and 24 - coated with grease or petroleum jelly) in cylinder end of valve body and on control ball stud end of valve spool. Install spool in bore from the control ball stud end to avoid O-ring interference during assembly.

2. Install washer (28), spacer (29), centering spring (30), washer (31), control ball stud sleeve (32), cap screw washer (33) and cap screw (34). Coat screw threads with a small amount of grade D "Locktite" or equivalent. Install a new self locking nut (21) and tighten until play between parts is removed. Be sure that the centering spring remains aligned between the two retaining washers. Back nut (21) off two flats (1/3 turn or 120^{0}). Install new cotter pin (20).

3. Start control ball stud sleeve plug (41) over the ball stud sleeve (32). Pack cavity in ball stud housing (41) in which centering spring (30) is contained at least half full of Special Multi-Purpose Grease (Symbol "S26" in Maintenance Manual X-6114, SEC. 13, LUBRICATION).

5. Install three new O-rings (24) in recesses in the valve body (25). Mate surfaces of valve and cylinder. Install ball (23) and check valve (19). The locating pin on the check valve retaining plug must mate with a recessed hole on the cylinder mating face to insure proper port alignment between cylinder and valve.

BOOSTER CYLINDER TROUBLESHOOTING CHART

TROUBLE	PROBABLE CAUSE	REMEDY
LOSS OF SYSTEM PRESSURE	SLIPPAGE OF PUMP DRIVE OTHER PUMP MALFUNCTION.	Refer to "Hydraulic Pump Trouble Shooting Chart."
CYLINDER PISTON ROD BINDING OR STICKING	CRAMPING OF LINKAGE.	With hydraulic flow shut off from the unit and the rod end uncoupled the rod should slide freely in or out by hand with a maximum force of 30 pounds. If binding is apparent, replace the unit and readjust Pitman arm stops to prevent recurrence of damage.
CHATTER CONDITIONS	LOOSE MOUNTINGS OR LINKAGE.	Make certain all ball stud mounting and other linkage is tight. Check Pitman arm stops to be certain the arm strikes the stops slightly before the steering knuckles contact the stops on the axle. Insufficient pump flow at idle speeds can be corrected by increasing engine idle rpm.
UNSATISFACTORY STEERING IN EITHER DIRECTION	AIR IN SYSTEM, EXCESSIVE WEAR IN STEERING CYLINDER. INCORRECT SYSTEM PRESSURE, WORN PUMP.	Check for air in system. Excessive noise or foamy condition of oil indicates aeration. Check to be sure air is not entering system through poor threads, hoses, pump seals, O-rings, gaskets and loose connections. Excessively worn cylinders result in leakage past the piston. Correct by replacing cylinder. Repair or replace pump.

6. Locate control ball stud housing (41) in desired position relative to control ball stud. Install four stud nuts (43) while holding valve end control assembly in place to prevent misalignment of O-rings. Tightening of the four stud nuts (43) should be done evenly and 180 degrees apart to prevent an out-of-square condition between the ball stud housing and valve body. The nuts should initially be tightened only snugly, and then tightened evenly to 30-40 foot-pounds after the control ball stud has been assembled. The ball stud then can be actuated to check if the spool is free. If the spool is not free, the nuts should be loosened and retightened.

7. Install control ball stud spacer (35). The spring washer (36) must be installed with its convex (raised inside diameter) face toward ball stud (38) to provide spring tension on ball stud. Next install ball stud seats (37) and control ball stud (38). Position the stud (38) and sleeve (32) so that the stud is centered in the sleeve opening.

8. Tighten control ball stud sleeve plug (40) snugly against seat (37). Back plug off until slot in plug lines with one of the lock pin anchor holes in sleeve which are spaced at 60° intervals in control ball stud sleeve. Install lock pin (44). Install washer (45) and snap ring (46).

9. Grease control ball stud housing, under low pressure, through grease fitting using recommended chassis lubricant.

Cylinder Reassembly

1. Coat the rod seal assembly parts (16) with petroleum jelly. Install two back-up rings over the rod and in the cylinder cap bore. Be sure that the split ends are staggered. Install the seal ring and two outer back-up rings, again with split ends staggered. Install the washer (15), retainer (14), wiper (13) and scraper (12). Install the snap ring (11).

2. Screw the rod end ball stud sub-assembly (3) on to the end of the rod. Install bolt (10) washer (2) and nut (1). Torque to 45-55 foot-pounds.

BOOSTER CYLINDER EXTENSION AND END SOCKET

The booster cylinder extension assembly is two-piece type, composed of an extension and an end socket assembly. Extension is flanged at end which attaches to booster cylinder and threaded at opposite end for attachment of end socket assembly.

End socket stud is held against a tapered bearing by a seat and spring. An end plug and lock wire hold these parts in their correct relative position in end socket (fig. 8).

MAINTENANCE

Tapered stud nut must be kept tight, as any looseness of stud at steering arm will cause hole in arm to become enlarged and result in premature replacement of parts. Tightening stud nut after wear has occurred will result in damage to dust covers and springs, particularly when turning to extreme right and left.

Normal wear on bearing surfaces in end socket will cause increase in overall height of assembly. If excessive play is noted, it is evident that worn parts or complete end socket assembly must be replaced.

At intervals indicated, apply recommended lubricant.

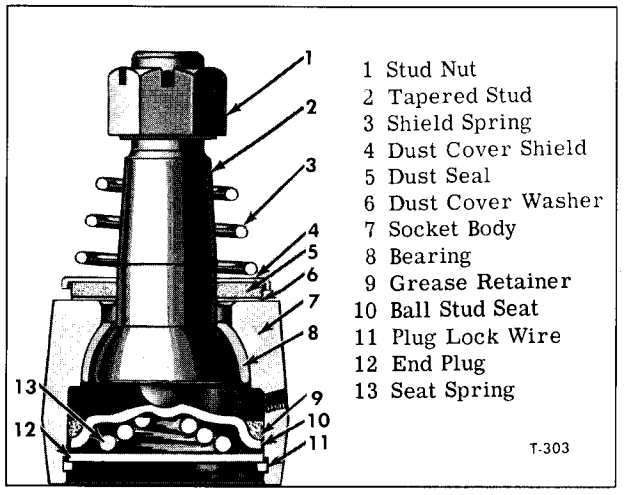


Figure 8—Booster Cylinder Extension End Socket

BOOSTER CYLINDER EXTENSION AND END SOCKET REPLACEMENT

REMOVAL

1. Remove cotter pin and nut attaching tapered end socket stud to right-hand steering arm. Strike steering arm a sharp blow with hammer as downward pressure is applied at end socket to remove stud from arm.

2. Remove four cotter pins, nuts, and bolts attaching extension to booster cylinder assembly. Discard cotter pins.

INSTALLATION

1. With the two clamp bolts loose, turn end socket onto extension until dimension from center-line of tapered stud to face of extension is 15.96". DO NOT TIGHTEN CLAMP BOLTS UNTIL INSTALLATION IS COMPLETE.

2. Set wheels in straight ahead position and extend booster cylinder to 36.42" (measure from C/L of piston rod end socket stud to C/L of cylinder ball stud).

3. Attach extension flange to booster cylinder flange using four bolts and nuts. Tighten bolts to 40-50 foot-pounds torque; then advance lock nuts to nearest cotter pin holes and install new pins.

4. Position dust cover washer, dust seal, dust cover seal, and spring over end socket tapered stud. Insert tapered stud in steering arm. When booster cylinder and end socket extension are preset to above dimensions, the stud should slip easily into hole in steering arm. Turn end socket on extension for further adjustment if necessary.

NOTE: If excessive adjustment is necessary, after pre-setting to above dimensions, this is an indication that something else is wrong. Check for bent steering arm, misaligned front end or worn components of steering linkage.

5. Attach tapered stud to steering arm with nut and new cotter pin. Tighten end socket clamp bolts to 45-55 foot-pounds torque.

BOOSTER CYLINDER EXTENSION AND END SOCKET OVERHAUL

DISASSEMBLY

Key numbers in text refer to figure 8.

1. Remove extension and end socket assembly as previously instructed. Loosen two clamp bolts and nuts; thread socket assembly off extension.

NOTE: If end socket body is not being repaired or replaced, there is no need for removal from extension.

2. Remove shield spring (3), dust cover shield (4), dust seal (5), and dust cover washer (6) from tapered stud (2).

3. Remove end plug lock wire (11), end plug (12), seat spring (13), stud seat (10), and grease retainer (9). When these parts are removed, tapered stud (2), and bearing (8) can easily be removed from end socket.

CLEANING AND INSPECTION

Immerse all parts in suitable cleaning solvent to loosen and remove all accumulated dirt and grease. Use stiff bristle brush and repeat immersions until all parts are clean.

Inspect all parts for evidence of excessive wear or corrosion. Inspect springs for loss of tension and broken coils. Discard seal and grease retainer. Replace defective and excessively worn parts wherever necessary.

ASSEMBLY

Key numbers in text refer to figure 8.

1. During assembly procedures, lubricate parts with lubricant recommended. Refer to LUBRICATION (SEC. 13) and Lubrication Chart at the back of Maintenance Manual X-6114 for recommended lubricant.

2. Install bearing (8) into end socket. Install tapered stud (2).

3. In the order listed, install the following parts into end socket; grease retainer (9), stud seat (10), spring (13), plug (12), and lock wire (11).

4. If removed, install lubrication fitting and fill with recommended lubricant. Refer to LUBRICATION (SEC. 13) and Lubrication Chart at the back of Maintenance Manual X-6114 for recommended lubricant.

5. Position dust cover washer (6), dust seal (5), dust cover shield (4), and shield spring (3) on tapered stud (2); then until ready to install the assembly on coach, install stud nut (1) to retain parts.

6. If socket end assembly was removed from extension, thread end socket on extension to a dimension of 15.96". Distance is measured from centerline of tapered stud to face of extension flange (fig. 6).

BOOSTER CYLINDER PISTON ROD END SOCKET

Power steering booster cylinder piston rod end socket is similar to booster cylinder extension end socket (fig. 8). Piston rod end socket threads directly on piston rod installed in booster cylinder assembly. Refer to "Booster Cylinder Extension and End Socket Overhaul" described earlier in this section for overhaul procedures.

BOOSTER CYLINDER PISTON ROD END SOCKET REPLACEMENT

REMOVAL

1. Remove cotter pin and stud nut attaching piston rod end socket stud to suspension support bracket. Using a puller, force socket stud from bracket.

2. Remove set screw; then loosen socket end clamp bolt. Thread socket assembly off piston rod.

3. Procedures required to overhaul booster cylinder piston rod end socket are the same as described previously under "Booster Cylinder Extension and End Socket Overhaul."

INSTALLATION

1. Compress booster cylinder assembly into fully retracted position; then thread booster cylinder piston rod end socket on piston rod to a dimension of 29.66". NOTE: Dimension is measured from centerline of end socket tapered stud to centerline of booster cylinder ball stud.

2. When booster cylinder is correctly adjusted, install set screw and clamp bolt. Tighten clamp bolt to 45-55 foot-pounds torque. Stake set screw in three places.

3. Reinstall piston rod end socket to suspension support bracket. Tighten stud nut to 150 foot-pounds torque. Secure nut with new cotter pin.

POWER STEERING DRAG LINK

Adjustable steering drag link assembly used with power steering is composed of two parts, drag link and end socket assembly (fig. 9). Drag link end socket assembly is roller-bearing type incorporating adjustable features which automatically compensate for normal wear. End socket assembly at Pitman arm end of drag link assembly threads on drag link and provides for length adjustment. End socket assembly is secured to drag link by a clamp bolt, nut, and lock washer. Opposite end of drag link engages booster cylinder ball stud and is secured by a stud nut and cotter pin.

MAINTENANCE

If steering linkage between the steering gear and front axle is out of adjustment, bent, twisted, or worn, steering action of coach will be seriously affected. At any time steering linkage parts are repaired, replaced, or adjusted, steering geometry and front wheel alignment must be checked.

Stud nuts at socket end and booster cylinder ball stud end of drag link must be kept tight or hole at ball stud end of drag link and hole in Pitman arm may be come enlarged as a result of excessive looseness. Subsequent tightening of stud nuts may draw studs into holes so far that dust cover parts may become damaged and result in premature replacement.

Drag link end socket is equipped with a lubrication fitting and should be lubricated at regular intervals.

DRAG LINK ADJUSTMENT

Drag link is adjusted properly when steering wheel is centered an equal number of turns between extreme right and left position, and the front wheels are positioned straight-ahead. In this position the centerline of hole at drag link end of the Pitman arm will be 0.50" to the left of centerline of coach when viewed from rear of front axle (fig. 6).

NOTE: Centerline of coach can be identified by prick punch marks on back of front axle beam.

1. If drag link needs adjustment, disconnect drag link at Pitman arm.

2. Loosen clamp bolt securing end socket to drag link. With Pitman arm positioned to dimension stated above (fig. 6) and front wheels straight ahead, turn end socket on drag link as required to align center of end stud with center of hole in Pitman arm. Attach end socket to Pitman arm. Tighten stud nut to 150 foot-pounds torque; then install new cotter pin.

IMPORTANT: Booster cylinder end of drag link must be tilted to same plane as flange of booster cylinder ball stud body before clamp bolt at Pitman arm end socket is tightened. Rotate link if necessary; then tighten clamp bolt to 45-55 ft.-lbs. torque.

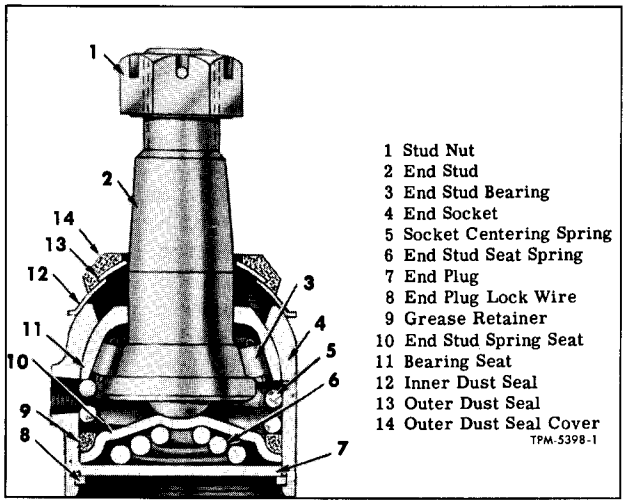


Figure 9—Power Steering Drag Link End Socket

DRAG LINK END SOCKET REPLACEMENT

Refer to "Steering Drag Link Adjustment" preceding for preliminary procedures which will apply for replacement of drag link end socket. In addition to adjustment procedures, remove end socket from drag link.

DRAG LINK END SOCKET OVERHAUL

DISASSEMBLY

Key numbers in text refer to figure 9.

1. Remove outer dust seal cover (14), outer dust seal (13), and inner dust seal (12) from end socket tapered stud.

2. Position end socket assembly in a vise and press end plug (7) in against spring pressure far enough to remove end plug lock wire (8), by using a screwdriver to pry lock wire out of groove in end socket (4).

3. Remove end plug (7), end stud seat spring (6), end stud spring seat (10), grease retainer (9), socket centering spring (5), tapered end stud (2), end stud bearing (3), and end stud bearing seat (11) from drag link socket end (4).

CLEANING AND INSPECTION

Key numbers in text refer to figure 9.

1. Clean all parts except outer dust seal cover (14) thoroughly in cleaning solvent. Wipe or blow parts dry.

2. Inspect all parts for corrosion and excessive wear. Discard all parts not in good condition.

3. Check socket centering spring (5) and end stud seat spring (6) for free length, compressed length, distortion, or collapsed coils.

4. Inspect bearing rollers in end stud bearing assembly (3) for roughness or flaking. If rollers will not rotate freely in retainer, replace bearing assembly.

5. Discard dust seals, dust cover, and grease retainer.

ASSEMBLY

Key numbers in text refer to figure 9.

When assembling adjustable drag link end socket assembly, be sure all parts and working area are thoroughly clean. If dirt or foreign matter is allowed to get into drag link end socket assembly, excessive wear and premature replacement of parts will be the result. Lubricate each part with recommended lubricant. Refer to LUBRICATION (SEC. 13) and Lubrication Chart at the back of Maintenance Manual X-6114 for recommended lubricant.

1. Position end stud bearing seat (11) and stud bearing (3) on tapered end stud.

2. Insert stud and bearing assembly into drag link end socket (4).

3. Position socket centering spring (5) in end socket (4) against end stud bearing seat (11).

4. Press new grease retainer (9) over end stud spring seat (10); then position retainer and seat in end socket (4).

5. Install end stud seat spring (6), and end plug (7) in end socket (4).

6. With end socket assembly positioned in vise, apply pressure against end plug to compress springs; then install end plug lock wire (8) in groove of end socket (4).

7. Position inner dust seal (12), outer dust seal (13), and outer dust seal cover (14) over threaded end of tapered end stud.

8. With drag link end socket assembly cleaned, inspected, and repaired, assemble to drag link and adjust as directed previously under "Drag Link Adjustment."

POWER STEERING HYDRAULIC PUMP

The power steering pump (fig. 10) is a vane type, hydraulic unit which supplies hydraulic power for operation of the steering booster cylinder at front axle. Pump is mounted at rear of engine (fig. 2), and is driven by the blower drive shaft through a coupling (fig. 11). The fluid reservoir and filter is remotely mounted and is connected to the hydraulic system by hoses (fig. 2).

OPERATION

PUMP OPERATION

Pumps are composed principally of a pressure plate, ring, rotor, vanes, and wear plate. (Refer to fig. 10). The rotor is driven within the pump ring by a drive shaft, coupled to a power source. As the rotor speed increases, centrifugal action causes the vanes to follow the cam-shaped contour of the pump ring (fig. 12). System pressure, fed behind the vanes, assures sealing contact of vanes on ring contour during normal operation.

The ring is shaped so that two opposing pumping chambers are formed, thus cancelling any hydraulic loads on the bearings. Radial movement of the vanes, and rotation of the rotor, causes the chamber area between vanes to increase in size at the inlet (large diameter) section of the ring. This results in a low pressure, or vacuum in the chamber. This pressure differential causes oil to flow into the inlet, where it is trapped between the rotating vanes and is forced, through porting in the pressure plate, to discharge into the system as the chamber size decreases at the pressure quadrant (small diameter) of the ring.

FLOW CONTROL AND RELIEF VALVE

Maximum pump delivery and maximum system pressure are determined by the integral flow control and relief valve in a special outlet cover used on pumps. This feature is illustrated schematically in figure 13. An orifice in the cover limits maximum flow. A pilot-operated type relief valve shifts to divert excess fluid delivery to reservoir, thus limiting the system pressure to a prescribed maximum.

View "A" shows the condition when the total pump delivery can be passed through the orifice. This condition usually occurs only at low drive speeds. The large spring chamber is connected to the pressure port through an orifice. Pressure in this chamber equalizes pressure at the other end of the relief valve spool and the light spring holds the spool closed. Pump delivery is blocked from the reservoir port by the spool land.

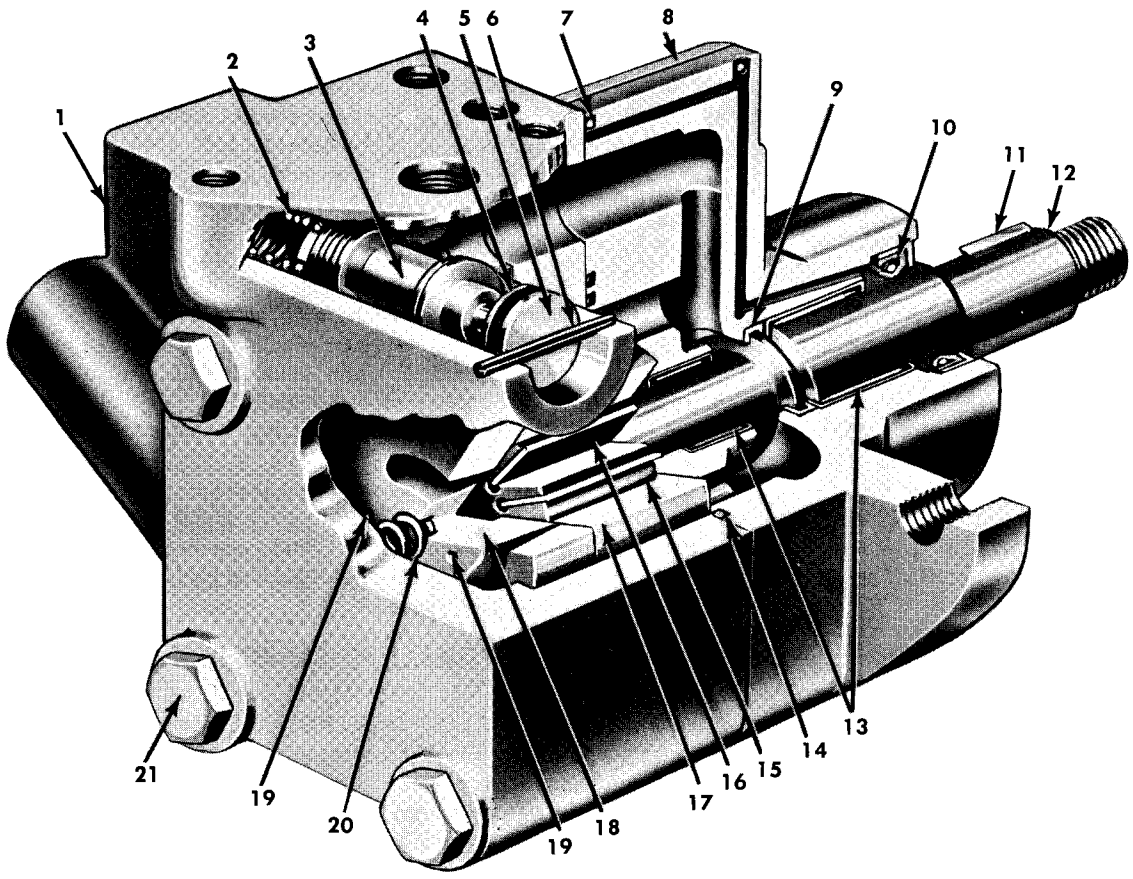
When pump delivery is more than the flow rate determined by the orifice plug, a pressure build-up forces the spool open against the light spring. Excess fluid is throttled past the spool to the reservoir port as shown in View "B."

If pressure in the system builds up to the relief valve setting (View "C"), the pilot poppet is forced off its seat. Fluid in the large spring chamber flows through the spool and out to reservoir. This flow causes a pressure differential on the spool, shifting it against the light spring. All pump delivery is thus permitted to flow to reservoir.

OPERATING INSTRUCTIONS

Normally, these pumps require no manual

POWER STEERING



1 Pump Cover Assy.	8 Pump Body	15 Pump Rotor
2 Control Valve Spring	9 Spacer	16 Rotor Vane
3 Control Valve Assy.	10 Shaft Seal	17 Pump Ring
4 Control Valve O-Ring	11 Key	18 Pressure Plate
5 Control Valve Plug	12 Rotor Shaft	19 Locating Pins
6 Valve Retainer Pin	13 Needle Bearing	20 Pressure Plate Spring
7 O-Ring	14 O-Ring	21 Pump Cover Cap Screw

T-211

Figure 10—Power Steering Hydraulic Pump

priming. However, it is essential that, after starting, a minimum drive speed of 600 RPM be held until the pump picks up its prime and pressure is built up in the system. Failure to observe the above precaution can result in scoring and possible seizure of the pump due to a lack of oil for lubrication.

MALFUNCTION

For diagnosis and remedy of trouble relative to power steering hydraulic pump see "Hydraulic Pump Trouble Shooting Chart."

HYDRAULIC PUMP REPLACEMENT

REMOVAL

Key numbers in text refer to figure 11.

1. Place a clean pan under power steering pump pressure and return flexible lines and pump ports to catch hydraulic fluid; then remove lines from pump by unscrewing fittings.

2. Remove bolts, nuts, and lock washers attaching power steering pump and adapter assembly to engine flywheel housing.

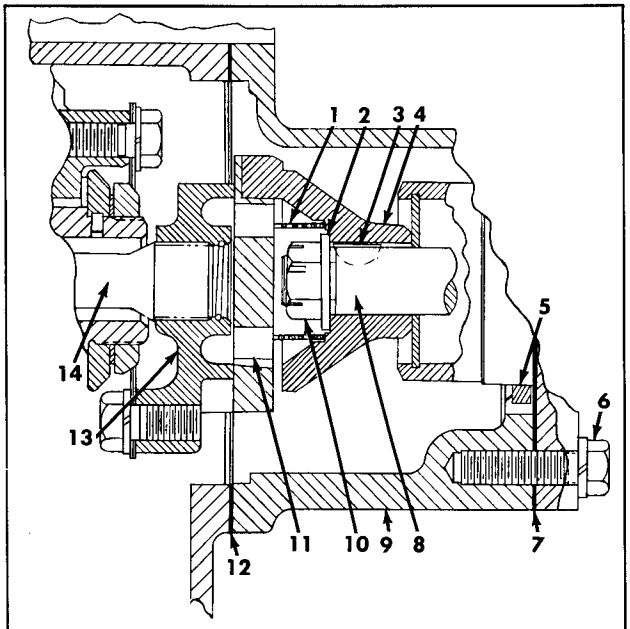
3. Using care to avoid dropping coupling ring (11) and coupling spring (1), remove pump and adapter assembly from engine.

4. Remove coupling ring (11) and coupling spring (1); then remove adapter to housing gasket (12). Discard gasket.

5. Remove lock nut (10) and plain washer (2) attaching driven hub (4) to pump drive shaft (8).

6. Remove two bolts (6) and lock washers attaching pump to adapter.

7. Remove adapter (9), adapter pilot ring (5), and gasket (7) from pump. Discard gasket.



1 Coupling Spring
2 Plain Washer
3 Driven Hub Key
4 Power Steering Pump Driven Hub
5 Pump to Adapter Pilot Ring
6 Pump to Adapter Attaching Bolt
7 Gasket
8 Pump Drive Shaft
9 Adapter
10 Nut
11 Pump Drive Coupling
12 Gasket
13 Driving Hub
14 Blower Drive Shaft

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Figure 11—Power Steering Drive Pump

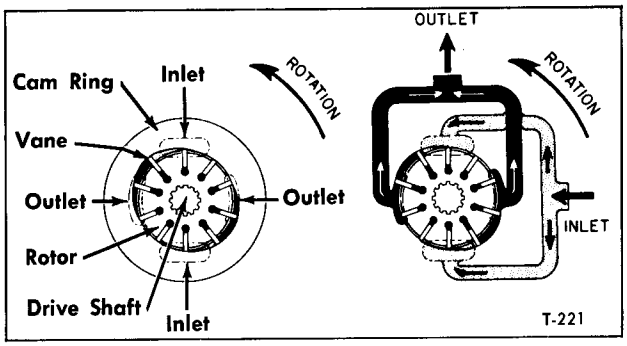


Figure 12—Operation and Fluid Flow

INSTALLATION

1. If previously removed, install Woodruff key (3) in slot of pump drive shaft (8).

2. Position pump driven hub (4) on pump drive shaft (8), aligning Woodruff key in drive shaft with slot in hub (4).

3. Install plain washer (2) and lock nut (10) attaching pump driven hub (4) to pump drive shaft (8).

4. Position adapter pilot ring (5) in the adapter (9); then attach adapter and new gasket (7) to power steering pump with two bolts and washers.

5. Install coupling spring (1) and coupling ring (11) in pump adapter, engaging prongs of driven hub (4) with slots in coupling ring (11).

6. Using new adapter to flywheel housing gasket (12), position pump and adapter assembly to flywheel housing, engaging prongs of driving hub

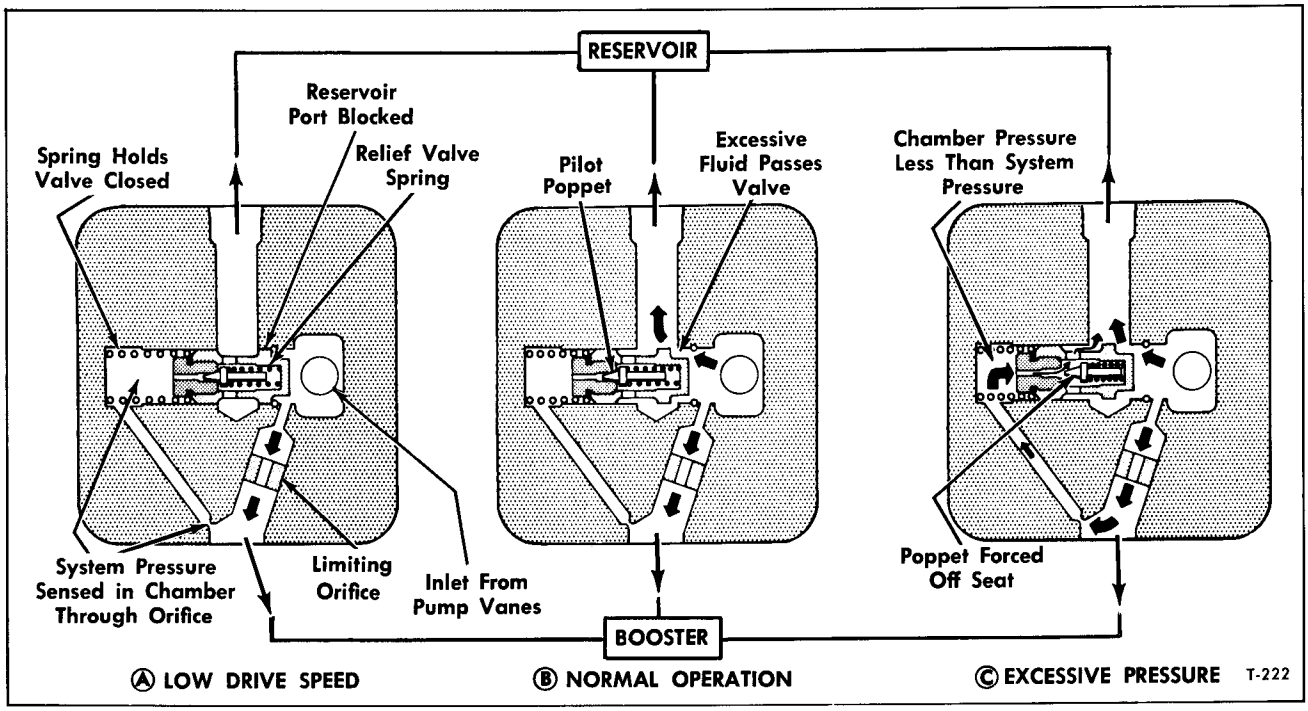


Figure 13—Hydraulic Pump Flow Control and Relief Valve Operation

POWER STEERING

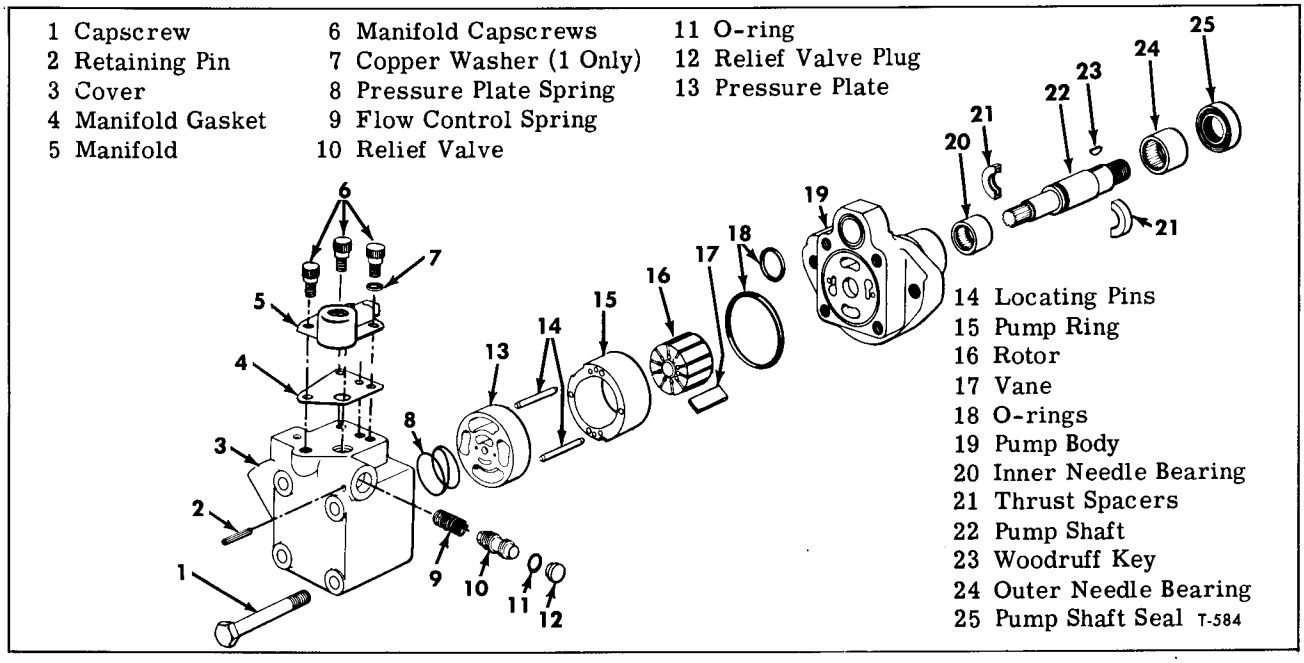


Figure 14—Power Steering Pump Components

(13) with slots in coupling ring (11).

7. Install adapter to flywheel housing, attaching with bolts, nuts, and lock washers. Tighten securely.

8. Connect power steering pump pressure and return flexible lines to pump. Tighten fittings firmly

9. Refill power steering hydraulic system and bleed system as described previously under "Bleeding Power Steering System."

HYDRAULIC PUMP OVERHAUL

Overhaul of power steering hydraulic pump must be undertaken in clean working area with pump removed from coach engine. It is important that overhaul procedures described in the following text be carefully followed.

DISASSEMBLY

Key numbers in text refer to figure 14.

1. Using a suitable cleaning solvent, thoroughly clean the exterior of the hydraulic pump to prevent entry of dirt or other foreign matter into the pump during overhaul procedures.

2. Remove three manifold capscrews (6) and copper washer (7). Remove manifold (5). Remove and discard manifold gasket (4).

3. Remove cover mounting capscrews (1) and separate the cover (3) from the pump body (19).

4. Remove pressure plate spring (8) and pressure plate (13).

5. Remove pump ring (15), locating pins (14), rotor (16) and vanes (17), and the two O-rings (18).

6. Mount the cover (3) in a vise. Drive out retaining pin (2) with a suitable punch. Protect the relief valve plug and subassembly against falling from bore. Work the plug (12), relief valve (10) and spring (9) from the bore.

NOTE: Access to the relief valve plug and subassembly may be gained through the large chamfered hole which leads to relief valve bore from inside the cover.

7. Support the shaft end of the pump body (19) in a two inch straight pipe coupling and, using an arbor press, remove the shaft (22), shaft thrust spacers (21), outer needle bearing (24) and shaft seal (25). The shaft assembly should drop through a slot in the press table so the shaft will not be damaged. The outer needle bearing and shaft seal are a press-fit to the body. Use a pin punch and hammer to tap the inner needle bearing (20) from the body (19).

INSPECTION

NOTE: Wash all parts, except seals, in clear mineral solvent and lay them aside for inspection. Replace all old seals and O-rings at reassembly.

1. Ring, Rotor, Vanes, Pressure Plate, Body - Inspect the surfaces of all parts which are subject to wear. Light scoring may be removed from the faces of the body or wear plate with crocus cloth (by placing the cloth on a flat surface), medium stone or by lapping. Check the edges of vanes for wear. Vanes must not have excessive play in slots or burrs on edges. Replace if necessary. Check each rotor slot for sticky vanes or wear. Vanes should drop in rotor slots by their own weight when both slot and vane are dry.

2. Relief Valve - Insert valve in its bore in pump cover. There should be no binding. Check valve and bore for excessive wear and scoring. Replace if necessary.

3. Bearings - Wash bearings thoroughly. Inspect and replace bearings if worn or damaged.

4. Shaft and Seal - Replace the shaft seal at each overhaul to prevent oil leakage. Check the drive shaft oil seal diameter for wear and scoring. Do not install a new seal on a shaft which is worn or damaged at the oil seal diameter. Replace the shaft if worn. Stone and polish the sharp edges on the shaft to prevent damage to the seal.

5. Body and Cover - Stone all mating surfaces with a medium stone to remove all burrs and sharp edges. Rewash all parts after stoning.

ASSEMBLY

NOTE: Immerse all parts in clean hydraulic oil to facilitate reassembly. Refer to figure 14.

1. Press inner needle bearing (20) in the body (19), using an arbor press.

2. Assemble the split-ring thrust spacer (21), on the shouldered portion of the shaft (22) and install shaft in the pump body (19).

3. Press outer needle bearing (24) onto shaft (22). The edge of the bearing must be 1/64" below the shaft seal shoulder when assembled. This provides for shaft end play of .010" to .015".

4. Position the seal (25) on the shaft end of the body (19), being careful not to damage seal. Press seal in until it engages the shoulder in the body. This shoulder acts as a positive stop for the seal. Do not over-press as damage to the seal will result.

5. Install locating pins (14) in pump body (19). Install pump ring (15) over pins in correct direction of rotation.

6. Position rotor (16) in pump ring (15) with chamfered edge of splined hole "in" or toward pump body (19). The chamfer facilitates assembly.

7. Install vanes (17) with their radius edge toward the inner ring contour.

8. Oil the pump ring (15) and rotor (16) with clean hydraulic oil and install pressure plate (13).

9. Install O-rings (18). Install pressure plate spring (8) and cover (3). Tighten cover screws (1) to 25-30 foot-pounds torque.

10. Install pressure compensating spring (9) in relief valve bore. Insert valve assembly (10) with the hex toward the spring. Install plug (12) with O-ring (11) in bore and hold it in position while driving a new retaining pin (2).

11. Position new manifold gasket (4) and manifold (5) on pump cover and secure manifold to pump body with screws (6). Copper washer (7) is used on screw where tapped hole enters oil passage. Tighten screws to 6-8 foot-pounds torque.

HYDRAULIC PUMP TROUBLESHOOTING CHART

TROUBLE	PROBABLE CAUSE	REMEDY
PUMP NOT DELIVERING OIL	DRIVEN IN WRONG DIRECTION OF ROTATION.	Check direction of pump shaft rotation.
	PUMP DRIVE SHAFT DISENGAGED OR SHEARED.	Remove pump; determine damage to cartridge parts (see disassembly instructions) replace sheared shaft and needed parts.
	FLOW CONTROL VALVE STUCK OPEN.	Disassemble pump and wash control valve in a clean solvent. Return valve to its bore and slide it back and forth. No stickiness in movement should occur. If a gritty feeling is noted on the valve O.D. it may be polished with crocus cloth. Avoid removal of excess material or rounding of valve edges *during this operation.* Do not attempt to polish the valve bore. Wash all parts before reassembly of pump. Flush entire system thoroughly and fill with clean oil.

POWER STEERING

HYDRAULIC PUMP TROUBLESHOOTING CHART (CONT'D)		
TROUBLE	PROBABLE CAUSE	REMEDY
PUMP NOT DELIVERING OIL	VANE OR VANES STUCK IN ROTOR SLOTS.	Disassemble pump, examine rotor slots for dirt, grime or small metal chips. Clean rotor and vanes, in a good grade solvent (mineral spirits or kerosene) reassemble parts and check for free vane movement.
	OIL VISCOSITY TOO HEAVY TO PICK UP PRIME.	Use fluid of the proper viscosity as recommended.
	PUMP INTAKE PARTIALLY BLOCKED.	Drain system completely; flush to clear pump passages. Flush and refill system with clean oil as per recommendations.
	AIR VENT FOR RESERVOIR CLOGGED OR DIRTY STRAINER.	Remove filler cap and clean air vent slot. Check filter or strainer in tank for clogged condition. Drain, flush and add clean oil to system if strainer was clogged.
PUMP MAKING NOISE	RESTRICTED OR PARTIALLY CLOGGED INTAKE LINE OR CLOGGED FILTER.	Pump must receive intake oil freely or cavitation will result. Drain system, and clean intake line and strainers. Add new oil and strain by recommended procedures.
	AIR LEAK AT PUMP INTAKE PIPING JOINTS OR PUMP SHAFT SEAL.	Test by pouring oil on joints and around drive shaft. Listen for change in operation. Tighten joints affected and replace pump drive shaft seal according to service instructions as outlined.
	COUPLING MISALIGNMENT.	Re-align and replace oil seal and bearings if damaged by shaft misalignment.
	RESERVOIR OR MANIFOLD SEAL LEAKAGE.	Leakage between manifold or reservoir at replenishing hole due to O-ring damage. Reservoir inlet tube to pump cover O-ring should be carefully examined for damage such as cuts, nicks, or dirt.

POWER STEERING FLUID RESERVOIR AND FILTER

FLUID RESERVOIR

Power steering fluid reservoir and filter assembly is bracket-mounted in upper right-hand corner of compartment (fig. 2).

It is recommended for inter-city operation, that every 100,000 miles (or 6 months, whichever occurs first), dependent upon operating conditions, the fluid reservoir cover should be removed and element replaced. Any time power steering reservoir has been serviced, power steering hydraulic system should be bled.

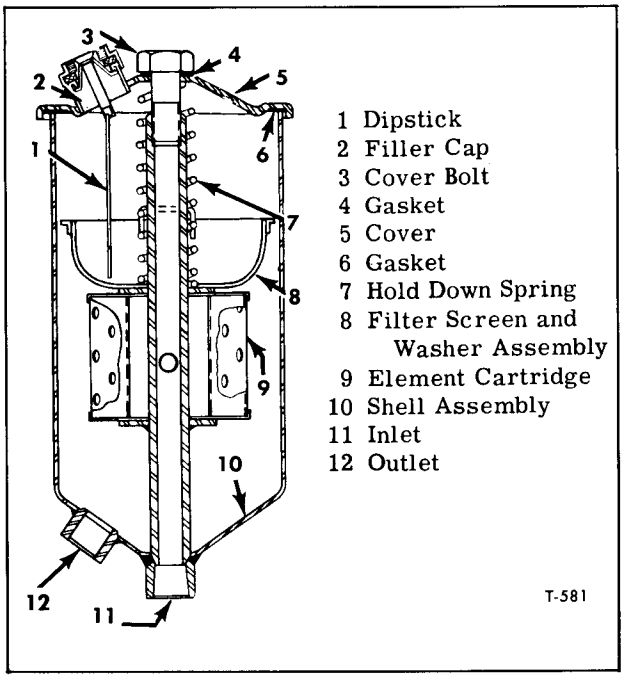


Figure 15—Power Steering Reservoir and Filter

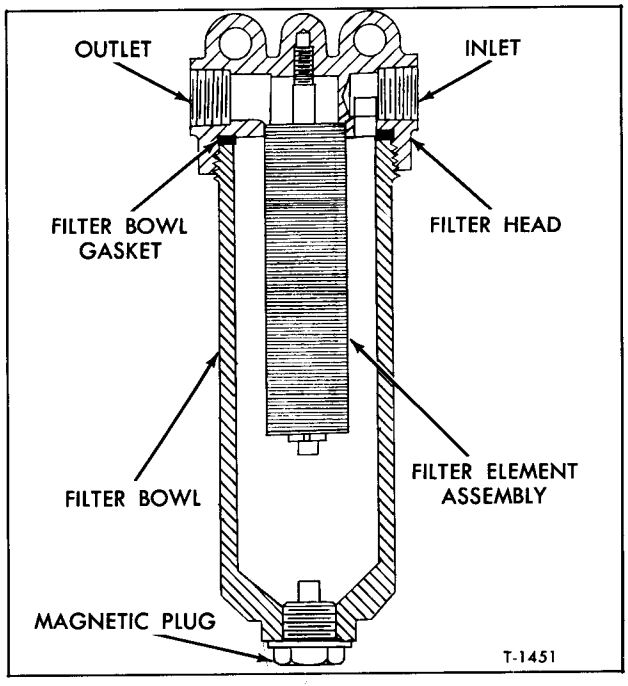


Figure 16—Fluid Line Filter Components

SERVICING RESERVOIR FILTER (Fig. 15)

1. Disconnect hose from reservoir outlet (12) and drain fluid.
2. Remove filler cap (2) and dipstick (1) assembly.
3. Remove cover bolt (3) and gasket (4).

CAUTION: Hold cover (5) so compression of spring (7) will not cause it to fly off.

4. Remove cover (5) and hold-down spring (7).
5. Remove basket-type filter screen and washer assembly (8).
6. Remove filter element cartridge (9).
7. Rinse filler cap (2) in suitable solvent to remove accumulated dirt. If unable to clean satisfactorily, replace with new cap and dipstick assembly.
8. Wipe out reservoir shell (10) with dry, clean, lint-free cloth.
9. Install new element cartridge (9).
10. Wash filter screen and washer assembly (8) in suitable solvent, dry thoroughly and install in shell (10).
11. Install hold-down spring (7).
12. Install new gasket (6) in cover (5) and place cover on shell.
13. Install new gasket (4) on cover bolt (3) and install bolt to secure cover.
14. Fill reservoir with fluid and bleed system as previously described.
15. Install filler cap (2) and dipstick (1) assembly.

FLUID LINE FILTER

Power steering fluid filter assembly is bracket-mounted to engine bulkhead (fig. 2).

At regular lubrication intervals, fluid filter bowl should be removed and element cleaned. Any time power steering fluid filter has been serviced, power steering hydraulic system should be bled. Refer to "Bleeding Power Steering Hydraulic System" explained earlier in this section.

SERVICING FLUID LINE FILTER
(Refer to Fig. 16)

NOTE: The fluid line filter assembly can be serviced without removing complete assembly from coach.

1. Using a wrench on wrench flats, turn filter bowl out of threads of filter head.
2. Remove and discard filter bowl gasket.
3. With a small wrench, unscrew filter element assembly from filter head. Use care to avoid damage to element. Clean parts, using cleaning solvent and compressed air.
4. Remove fluid line filter drain plug from bottom of filter bowl. Clean all metallic material from plug magnets.
5. Reassemble filter; then bleed hydraulic system as directed earlier under "Bleeding Power Steering Hydraulic System."

POWER STEERING

SPECIFICATIONS

HYDRAULIC PUMP

Make	Vickers
Model	VTM27-50-40-10-ME-L1-10-S9
Type	Hydraulic Vane
Capacity (@ 170° F. and "0" psi)	4.3 Gal. per Minute at 1200 R.P.M.

PUMP ROTOR

Width	0.7693"-0.7695"
Outside Diameter	1.5930"-1.5980"
Number Vane Slots	10
Vane Slot Width	0.0780"-0.0785"

ROTOR VANES

Quantity	10
Thickness	0.0770"-0.0775"
Width	0.3430"
Length	0.7689"-0.7692"

OUTER BEARING

Type	Needle
Fits Housing Bore Diameter	1.1245"-1.1255"
Fits Shaft Diameter	0.8745"-0.8750"
Width	0.7400"-0.7500"

INNER BEARING

Type	Needle
Fits Housing Bore Diameter	0.7495"-0.7505"
Fits Shaft Diameter	0.5620"-0.5625"
Width	0.6150"-0.6250"

FLOW CONTROL VALVE

Opening Pressure	1000 psi (±50)

FLOW CONTROL VALVE SPRING

Free Length	2.5470"
Compressed Length Under 6.25 lbs.	1.2970"
8.2 lbs.	0.9060"

PUMP SHAFT

Diameter at Inner Bearing	0.5620"-0.5625"
Diameter at Outer Bearing	0.8745"-0.8750"
Length of Spline	0.6250"
Number of Splines	14

POWER STEERING BOOSTER CYLINDER

Make	Vickers
Model	S20A22-000XNN14N-10-011
Type	Hydraulic

Length (end of push rod w/o socket to center of control stud)	Retracted	Extended
	27.406"	41.500"

STROKE	14 3/32"
Booster Cylinder Extension and End Socket Adjusted Length (Centerline of End Socket Tapered Stud to Outside Edge of Flange)	15.96"

VALVE CENTERING SPRING

Free Length	1.437"
Compressed Length Under 75 lbs.	1.062"
Compressed Length Under 100 lbs.	0.937"

STEERING DRAG LINK

Type	Adjustable Length
Length—Stud Centers	14.62"

SPRINGS

Stud Seat Spring

Free Length	0.750"
Compressed Length Under 350-400 lbs.	0.500"

SOCKET CENTERING SPRING

Free Length	1.250"
Compressed Length Under 30 lbs.	0.875"

RESERVOIR AND FILTER

Element	Disposable Cartridge

CARTRIDGE HOLD DOWN SPRING

Free Length	5.50"
Compressed Length Under 16 lbs.	4.50"

TORQUE SPECIFICATIONS

Location	Ft.-Lbs.
Cover to Pump Body Bolt	25-30
Booster Cylinder Flange to Extension Flange Bolts	40-50
Drag Link to Booster Cylinder Ball Stud Nut and advance to nearest cotter pin hole.	150
Piston Rod End Socket Stud to Support Bracket Stud Nut and advance to nearest cotter pin hole.	150
Extension End Socket Stud to Steering Arm Nut and advance to nearest cotter pin hole.	150
Drag Link Stud to Pitman Arm Nut and advance to nearest cotter pin hole.	150
Piston Rod End Socket to Piston Rod Bolt—Nut	45-55
Extension End Socket Clamp Bolt—Nut	45-55
Drag Link Socket Bolt—Nut	45-55
Pump Manifold Capscrews	6-8

Air Conditioning System

Information contained in "AIR CONDITIONING" (SEC 26) in Maintenance Manual X-6114 also applies to late production coaches covered by this manual except for the new information contained herein. In most instances the new information is arranged in same sequence and under same subject headings as in X-6114.

GENERAL DESCRIPTION AND OPERATION

The controls and the operation of air conditioning system in current production coaches remains the same as described in Maintenance Manual X-6114 except that there are two blower motors and two magnetic switches as explained in this supplement in SECTION 3 under "HEATING AND VENTILATION."

REFRIGERANT

A number of refrigerants are available commercially under various trade names, however, when selecting refrigerant, only refrigerant-12 should be used in charging the air condition system in coaches covered by this supplement.

REFRIGERANT DEHYDRATOR - STRAINER

A new larger dehydrator-strainer is used on late production coaches. Installed between the dehydrator-strainer and refrigerant receiver tank is a freon charging valve assembly which can be used either to add refrigerant to the system or to evacuate refrigerant from system.

Procedure for replacing the dehydrator-strainer is same as given in Maintenance Manual X-6114, page 66 (SEC. 26). Figure 1 shows the new, larger unit and the charging valve installed.

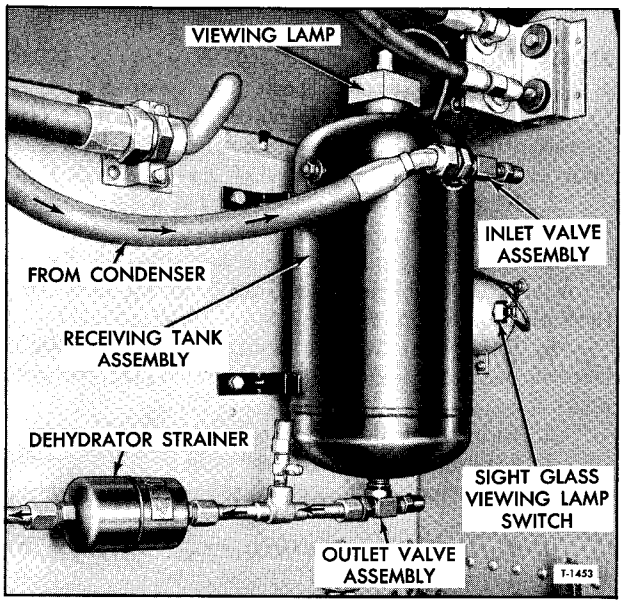


Figure 1—Dehydrator—Strainer and Refrigerant Charging Valve Installed

EXPANSION VALVE AND REMOTE BULB

Refrigerant expansion valve is same as on earlier coaches and same maintenance and adjustment procedures apply. The remote bulb, however, is not inserted into evaporator suction manifold, but is clamped in position on side of the evaporator outlet manifold.

CONDENSER FAN AND DRIVE

Condenser cooling fan is driven in same man-

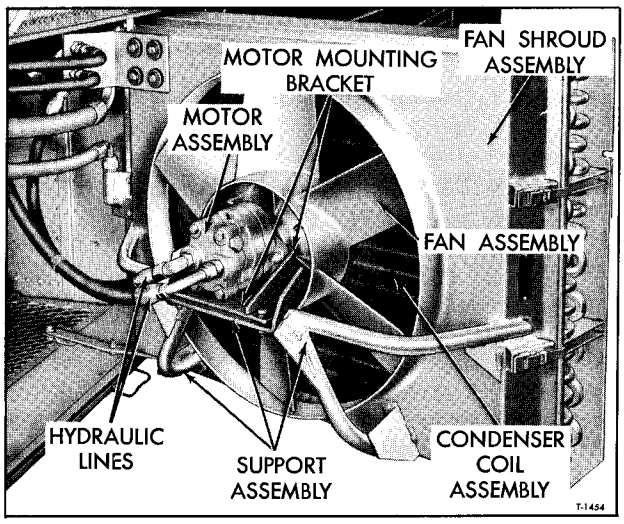


Figure 2—Condenser Fan and Motor Installed

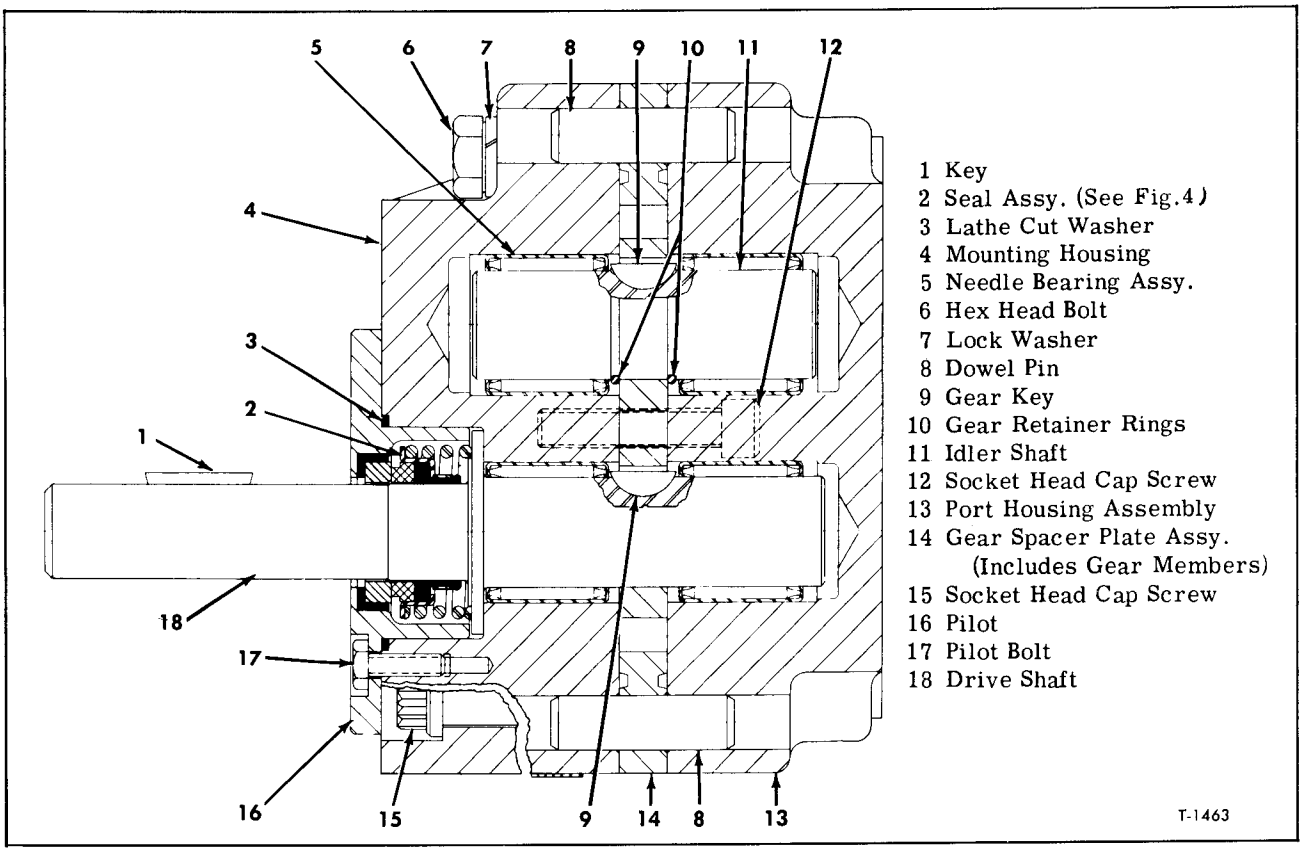


Figure 3—Sectional View of Condenser Fan Drive Hydraulic Pump

ner as on earlier model coaches, but both the hydraulic pump and the motor are of improved design. Also the hydraulic motor mounting bracket and support have been changed. Figure 2 shows the condenser fan and motor installed with the latest support assembly and mounting bracket.

The fan hub is keyed to motor shaft and provision to allow aligning fan blades with the shroud is same as on earlier vehicles. The method of attaching fan motor bracket to support is same on early and late coaches.

FAN BLADE AND PUMP PULLEY REPLACEMENT

When it becomes necessary to remove either the fan blade assembly from hydraulic motor, or the pulley assembly from the hydraulic pump; it is extremely important to REFRAIN FROM USING HAMMER to strike either the hubs or the shafts during the procedure. SERIOUS DAMAGE TO SHAFT SEALS OR OTHER INTERNAL PARTS MAY OCCUR IF HAMMER IS USED.

If difficulty is experienced in removing hubs, it is suggested that a suitable puller tool be used to remove hubs.

CONDENSER FAN DRIVE PUMP OVERHAUL

(Key numbers in text refer to figure 3, except as otherwise indicated)

PUMP DISASSEMBLY

1. Remove key (1) from keyway in shaft (18).
2. Remove bolts (17) which secure pilot (16) to mounting housing (4). Slide pilot (16) with seal seat and gasket out of housing and off shaft (18).
3. Remove seal gasket and seal seat (1 and 2, fig. 4) from pilot.
4. Using fingers, remove seal face (3, fig. 4) from shaft. Do not use metal tools as edges of seal face may be chipped.
5. Using needle-nosed pliers, remove shell, friction washer, and spring (4, 5, and 6, fig. 4) from shaft.
6. Remove lathe cut washer (3).
7. Scribe a mark across pump body to assure original positioning of parts when assembling pump later.
8. Through ports in housing (13) remove the socket-head cap screws (12).
9. Remove the hex-head bolts and lock washers (6 and 7), and with socket wrench, remove cap screws (15).

10. Using a soft lead hammer, tap alternately on ears of the two housings (4 and 13) to gradually separate the pump sections. The port housing (13) must be removed first, then remove the spacer plate and gears (14) with idler shaft (11). Drive shaft (18) cannot be removed from mounting housing (4) until gear key (9) has been removed.

CAUTION: DO NOT ATTEMPT TO PRY SECTIONS APART AS DAMAGE TO LAPPED SEALING SURFACES WILL OCCUR. Do not nick lapped surfaces of mounting housing (4), plate assembly (14) and port housing (13).

10. After pump drive gear has been removed from drive shaft (18), remove key (9) from shaft, and slide drive shaft out through bearing in mounting housing (4).

11. To remove gear from idler shaft (11), remove gear retainer rings (10) from shift grooves, then slide gear off shaft and remove key.

12. If inspection reveals a need for replacing shaft bearings (5), a suitable puller can be used to remove each bearing assembly from respective housing bore. Bearings will usually be damaged in the removal operation.

CLEANING AND INSPECTION

Key numbers in text refer to figure 3.

1. Wash all parts in cleaning solvent.

2. Inspect shaft surfaces which are contacted by bearings. If wear or scoring is evident, new shaft should be installed.

3. Inspect thrust face on drive shaft flange where contact is made with mounting housing; also inspect mating contact surface on housing (4). If the thrust surfaces are worn or scored, new parts should be used when assembling pump.

4. Carefully inspect pump gears and spacer plate, if sides of gears or gear teeth are worn, replace spacer plate and gears as a matched unit.

5. Inspect all of the components of drive shaft seal assembly (fig. 4). Use a new seal assembly when assembling pump if any of the parts are found to be defective or damaged.

IMPORTANT: After inspection, cover all parts to prevent dust or foreign matter from collecting on surfaces. Absolutely no dirt should be permitted on any part to be assembled.

ASSEMBLY

Key numbers refer to figure 3, unless otherwise indicated.

1. If shaft bearings (5) have been removed from either housing (4 or 13), use suitable installer to press new bearings into housing bores. Bearings must be located as shown in figure 3., i.e., far enough into bore so that, when pump is assembled the retaining rings (10) on idler shaft (11), and gear keys (9) will not contact bearing housings.

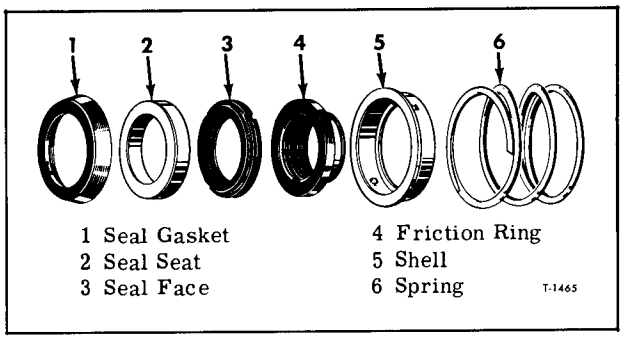


Figure 4—Hydraulic Pump and Motor Shaft Seal Components

2. Lubricate drive shaft surfaces with light weight engine oil, then insert drive shaft (18) through bearing in mounting housing (13) and install gear key (9) in keyway.

3. If gear has been removed from idler shaft (11), install key (9) in keyway and install one retainer ring (10). Install gear on shaft, then install other retaining ring (10).

4. With mounting housing and drive shaft supported with spacer plate side facing upward, and light weight engine oil applied to gears, bearings and shaft surfaces, insert idler shaft (11) into bearing in mounting housing (4). Install gear on drive shaft (18) with keyway in gear engaged with key (9).

5. Place spacer plate assembly over gears, with alignment mark made at disassembly aligned with mark on mounting housing. Dowel pins will guide the spacer plate into position.

6. Referring to mark made at disassembly, install port housing assembly (13) over ends of shafts (11 and 18) and dowel pins (8).

7. Through port openings in housing (13), install socket head cap screws (12). Tap housings with lead hammer as cap screws (12) are tightened to seat the housings at spacer plate.

8. Install hex-head bolts (6) with lockwashers (7) and tighten bolts evenly and firmly. Install cap screws (15) and tighten with socket wrench.

9. Referring to figure 4, place seal seat (2) in gasket (1) and install these two parts in recess in pilot. Lapped surface on seal seat must face outward. Be sure seat gasket is down against bottom of counterbore in pilot (16).

10. IMPORTANT: Check exposed surfaces of drive shaft (18) for burrs and sharp edges. If necessary use polishing stone to smooth edges. Apply light engine oil on exposed end of shaft.

11. Referring to figure 4 for key numbers used in this step, assemble seal parts as follows:

a. Insert friction ring (4) inside of shell (5) so that large lip of friction ring (4) is seated beneath the two lugs in I.D. of shell (5).

b. Slide spring (6) over shell (5) until spring is seated at shoulder on shell.

c. Lubricate I.D. of friction ring (4) with light engine oil; then place seal face (3) in shell so that two slots on seal face engage two lugs on shell (5). Lubricate seal face with a few drops of engine oil.

d. Install the spring (6), shell (5), friction ring (4), and seal face (3) as an assembly over drive shaft. Use care to keep seal face (3) engaged with lugs in shell (5). Press seal parts down with fingers until spring contacts drive shaft thrust flange.

12. Install lathe cut washer (3) in recess in mounting housing (4). Apply oil on seal face and seal seat, then position pilot (16) with seat and gasket over end of drive shaft and push down all the way. Remove pilot and check friction ring movement. Compress spring by pushing on seal face, then release. Friction ring must slide back with force of spring.

13. Assemble pilot (16) to pump and attach with pilot bolts (17).

FAN DRIVE MOTOR OVERHAUL

MOTOR DISASSEMBLY

Key numbers in text refer to figure 5, unless otherwise indicated.

1. Remove key (1) from drive shaft (22).

2. Remove bolts (21) which attach pilot (4) to mounting housing (6). Slide pilot with seal seat and gasket out of housing and off end of shaft (22).

3. Remove seal gasket and seal seat (1 and 2, fig. 4) from recess in pilot (4).

4. Using fingers, remove seal face (3, fig. 4) from shaft. Do not use metal tools as the seal face edges may be chipped.

5. Using needle nose pliers, remove shell, friction washer, and spring (4, 5, and 6, fig. 4) from shaft.

6. Remove lathe cut washer (3).

7. Scribe a mark across motor body to assure original positioning of parts when assembling.

8. Remove the four valve block bolts (18), then separate valve block assembly (16) from port housing and remove four plastic shims (15). Remove O-ring (17) from groove in port housing.

9. Remove the two socket head cap screws (14) which attach the port housing (12) to mounting housing (6). Also remove the hex head bolts (8) and lock washers (9).

10. Using a soft lead hammer, tap alternately on ears of housings to gradually separate the motor body sections. The port housing assembly (12) must be removed first, then remove the spacer plate and gears (11) with idler shaft (5). Drive shaft (22) cannot be removed from mounting housing (6) until gear key (19) has been removed.

CAUTION: DO NOT ATTEMPT TO PRY SECTIONS OF MOTOR APART AS DAMAGE TO SEALING SURFACES WILL OCCUR. Use care not to nick the lapped surfaces on port housing (12), spacer plate (11) and mounting housing (6).

11. After drive gear has been removed from shaft (22), remove gear key from keyway in shaft and slide drive shaft (22) out through bearing in mounting housing (6).

12. To remove gear from idler shaft (5), remove gear retainer rings (7) from shaft grooves, then slide gear off shaft and remove key.

13. If inspection reveals a need for replacing shaft bearings (13), a suitable puller can be used to remove each bearing assembly from respective housing bore. Bearings will usually be damaged in the removal operation.

14. Remove plugs (25), O-rings (24), springs (26 and 27), and pistons (23 and 28) from valve block (16). Be careful not to lose shims (29) between relief valve spring (27) and plug (25).

CLEANING AND INSPECTION

1. Wash all parts in cleaning solvent, and use air hose to remove loose dirt particles from housing cavities.

2. Examine pistons (23 and 28) and respective bores in valve block. Neither the pistons nor bores should be scored or excessively worn.

3. Check valve piston springs which must be in good condition.

4. Examine shaft surfaces which are contacted by bearing rollers. If these surfaces are rough or show evidence of wear, new shafts should be obtained for use when assembling motor. If thrust flange on drive shaft is scored, the drive shaft should be replaced.

5. Inspect all components of drive shaft seal assembly (fig. 4). Use a new seal assembly when assembling motor, if any of the seal parts are found to be defective or damaged.

6. Note condition of spacer plate and gears. If sides of gears are worn or if gear teeth are not in good condition, the spacer plate and gears must be replaced as a matched unit.

IMPORTANT: After inspection, cover all parts to prevent dust or foreign matter from collecting on surfaces. Absolutely no dirt should be permitted on any part to be assembled.

ASSEMBLY

Key numbers in text refer to figure 5, unless otherwise indicated.

1. If new shaft bearings (13) are being installed, use suitable installer to press new bearings into housing bores. Bearings must be located as shown in figure 5, i.e., far enough into bore so that

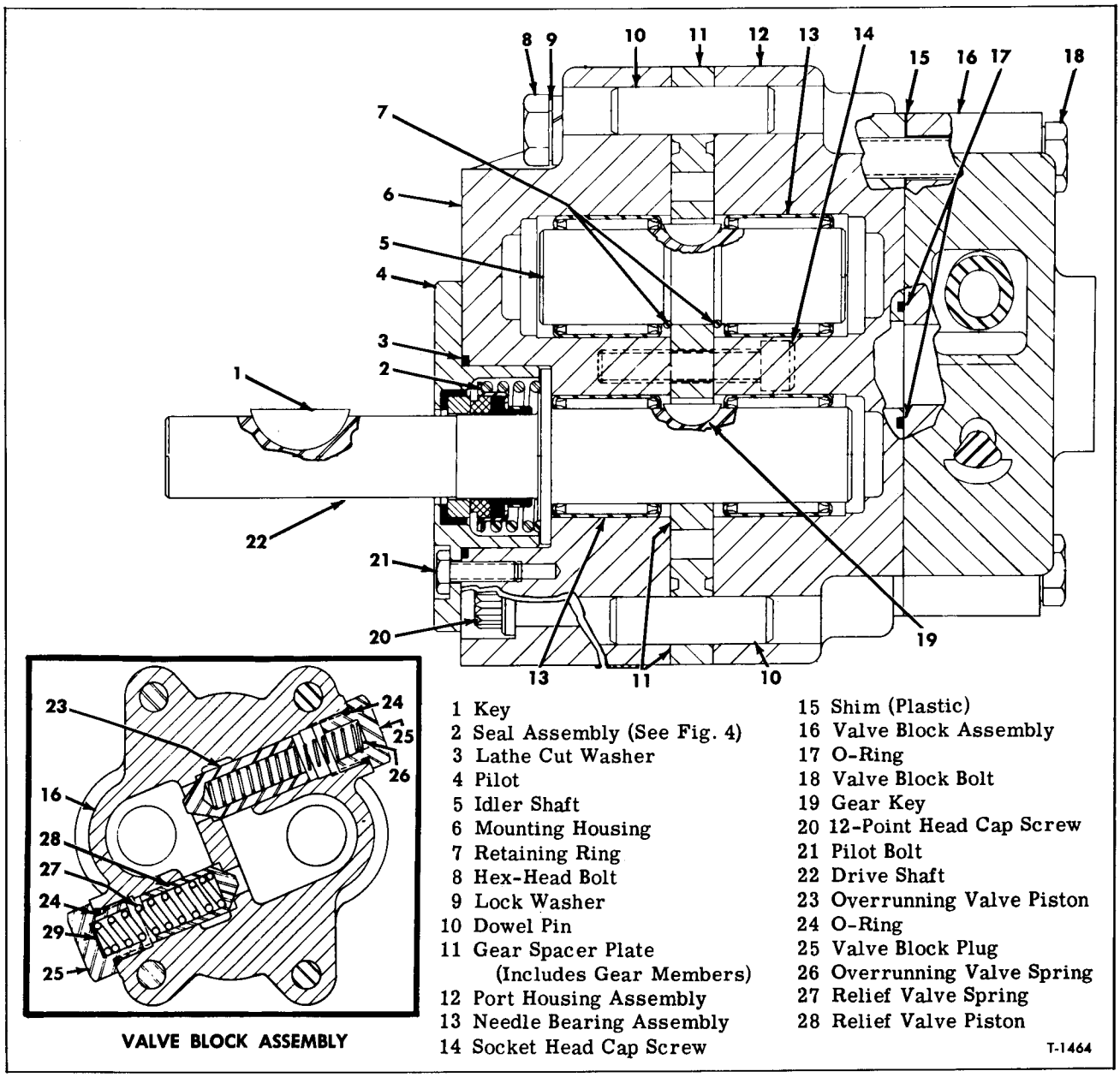


Figure 5—Sectional View of Condenser Fan Drive Motor

when motor is assembled, the retaining rings (7) on idler shaft (5) and gear keys (19) will not contact bearing housings.

2. Lubricate drive shaft surfaces with light engine oil, then insert drive shaft (22) through bearing in mounting housing assembly (6), and install gear key (19) in keyway.

3. If gear has been removed from idler shaft (5), install gear key in keyway and install one retaining ring (7). Install gear on idler shaft and install other retaining ring.

4. Support mounting housing and drive shaft assembly with spacer plate side facing upward. Lubricate idler gear and shaft with light weight engine oil, then insert one end of idler shaft into bearing in mounting housing. Install gear on drive shaft with keyway in gear engaged with key (19).

5. Install spacer plate (11) with dowel pins (10) fitting into holes in mounting housing and alignment mark (made when disassembling) indexed with mark on mounting housing (6).

6. Referring to mark made at disassembly, install port housing assembly (12) over ends of shafts (5 and 22) and dowel pins (10).

7. Through port openings in housing (12), install socket head cap screws (14), tightening screws

alternately and gradually until motor parts are firmly seated.

8. Install hex-head cap screws (8) with lock washers (9) and install cap screws (20) using 12-point socket wrench. Tighten bolts and cap screws (8 and 20) evenly and firmly.

9. Place gasket and seal seat (1 and 2, fig. 4) in pilot (4) with lapped surface on seal seat facing outward. Be sure seat gasket is down against bottom of counterbore in pilot (4).

10. IMPORTANT: Check exposed surfaces of drive shaft (22) for burrs and sharp edges. If necessary use polishing stone to smooth edges. Apply light engine oil on exposed end of shaft.

11. Referring to figure 4 for key numbers used in this step, assemble seal parts as follows:

a. Insert friction ring (4) inside of shell (5) so that large lip of friction ring (4) is seated beneath the two lugs in I.D. of shell (5).

b. Slide spring (6) over shell (5) until spring is seated at shoulder on shell.

c. Lubricate I.D. of friction ring (4) with light engine oil; then place seal face (3) in shell so that two slots on seal face engage two lugs on shell (5). Lubricate seal face with a few drops of engine oil.

d. Install the spring (6), shell (5), friction ring (4), and seal face (3) as an assembly over drive shaft. Use care to keep seal face (3) engaged with lugs in shell (5). Press seal parts down with fingers until spring contacts drive shaft thrust flange.

12. Install lathe cut washer (3) in recess in mounting housing (6). Apply oil on seal face and seal seat, then position pilot (4) with seat and gasket over end of drive shaft and push down all the way. Remove pilot and check friction ring movement. Compress spring by pushing on seal face, then release. Friction ring must slide back with force of spring.

13. Assemble pilot (4) to motor and attach with pilot bolts (21).

14. Referring to sectional view of valve block (fig. 5), install relief valve piston (28), spring (27), shims (29), O-ring (24) and plug (25) into valve block as shown. At other port, install over-running valve piston (23), piston spring (26), O-ring (24) and plug (25) into valve block as shown.

NOTE: At this time relief valve setting within valve block can be checked by installing a flat surface plate and gasket to motor side of block, then with a pressure gauge installed into special oil pressure supply line, apply pressure to block inlet port. Note pressure reading when relief valve opens. Relief valve should open at 1500 psi.

15. With O-rings (17) located in grooves in port housing (12), install valve block assembly (16) to port housing with four valve block bolts (18). Use one plastic shim (15) between valve block and port housing at each bolt (18).

REFRIGERANT COMPRESSOR

The refrigerant compressor used on current production coaches is same as was used on earlier vehicles.

When following the A/C compressor overhaul procedure given in Maintenance Manual X-6114, refer to figure 6 in this section which has fittings and valves properly identified. Figure 51, page 42, (SEC. 26) in Manual X-6114 is incorrect.

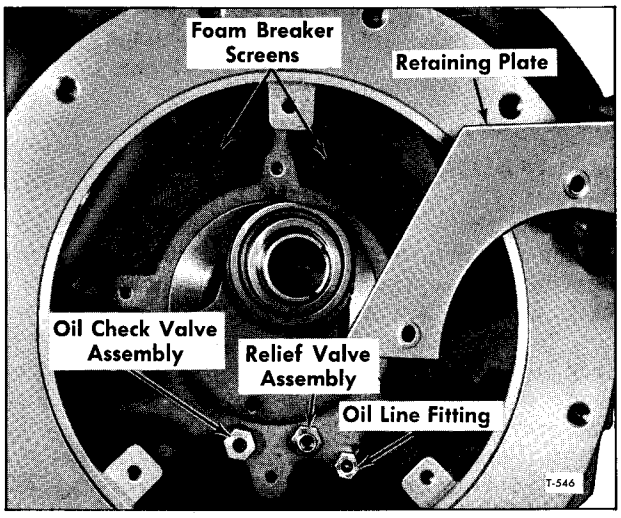


Figure 6—Compressor Foam Breaker Screens, and Valves Installed

Compressor mounting brackets and drive mechanism have been modified as later explained under pertinent headings. The modifications affect compressor replacement and alignment procedures.

COMPRESSOR MOUNTING AND DRIVE COUPLING

Illustrations of latest compressor mounting brackets are shown in figures 8 and 13, and procedure for disconnecting compressor mountings from brackets are included later under "Refrigerant Compressor Replacement."

The drive coupling assembly shown in figure 11, constitutes two riveted disc assemblies which are attached to a common plate and welded stud assembly. The disc assemblies each consist of a pair of metal stampings which enclose four flexible rubber bushings.

At compressor, two bolts with self-locking nuts secure coupling to a splined drive flange, while the

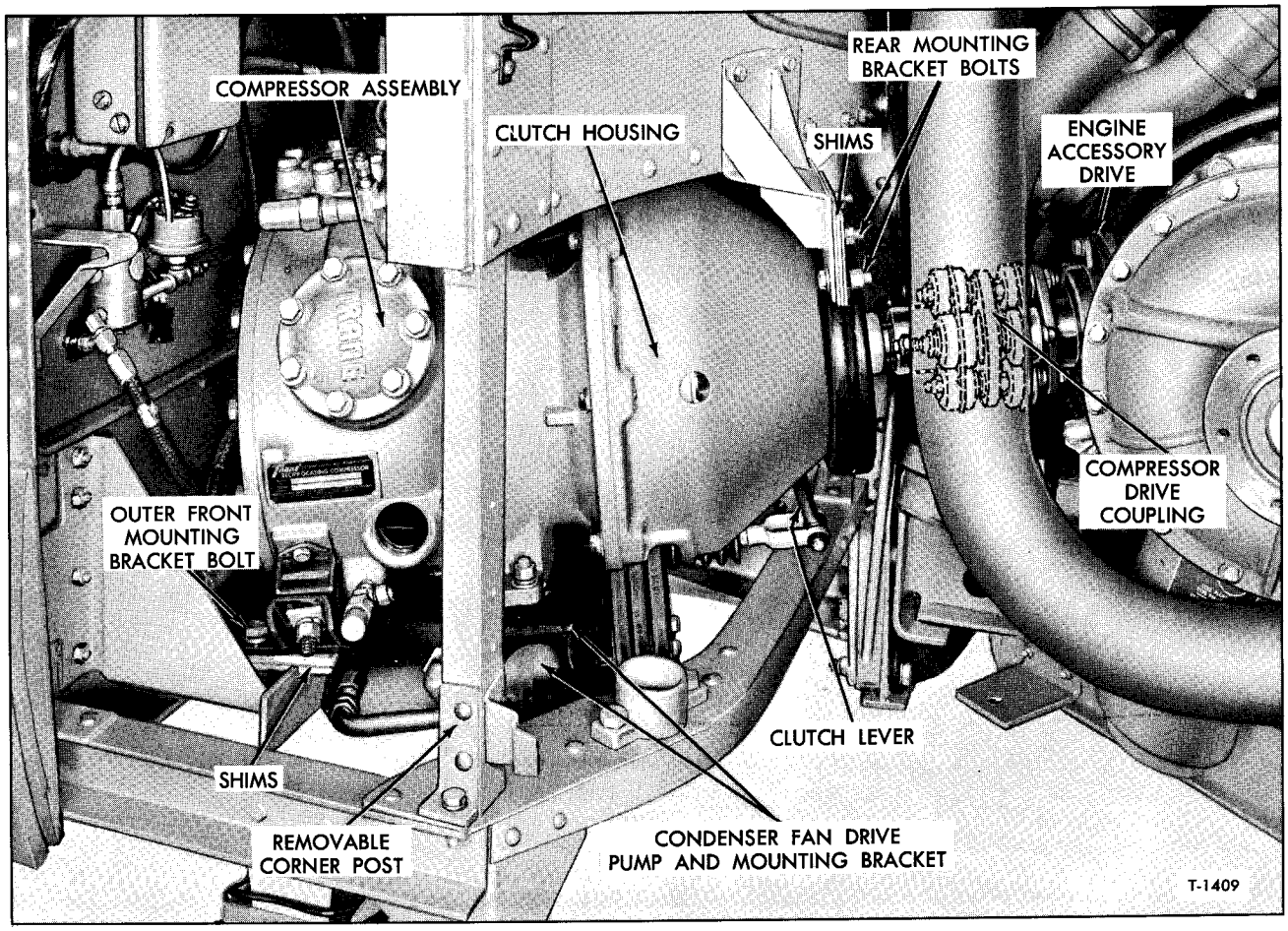


Figure 7—Refrigerant Compressor and Clutch Assembly Installed (Radiator Removed)

other end of coupling is connected to the drive flange on engine accessory drive in same manner. Coupling replacement is covered later under "Replacing Refrigerant Compressor Drive Coupling."

COMPRESSOR REPLACEMENT AND ALIGNMENT

REFRIGERANT COMPRESSOR REMOVAL

The procedure covering refrigerant compressor removal in SECTION 26 of Manual X-6114 are applicable to late production coaches with exception of operations given below.

Refer to figure 7 for view of compressor installed in coach and to figure 8 for view of compressor mounting brackets and shims.

After accomplishing the removal procedure given in steps 1 through 11 under "Compressor Replacement" in Maintenance Manual X-6114 (SEC. 26), complete the compressor removal on late coaches by performing following steps:

1. Remove the two bolts which secure the compressor front mounting bracket assembly to front bracket (2, fig. 8) which is mounted on compartment bulkhead. Remove and tag the shims (fig. 8) at each front mounting point, so the shims can be reinstalled in original locations when compressor is installed.

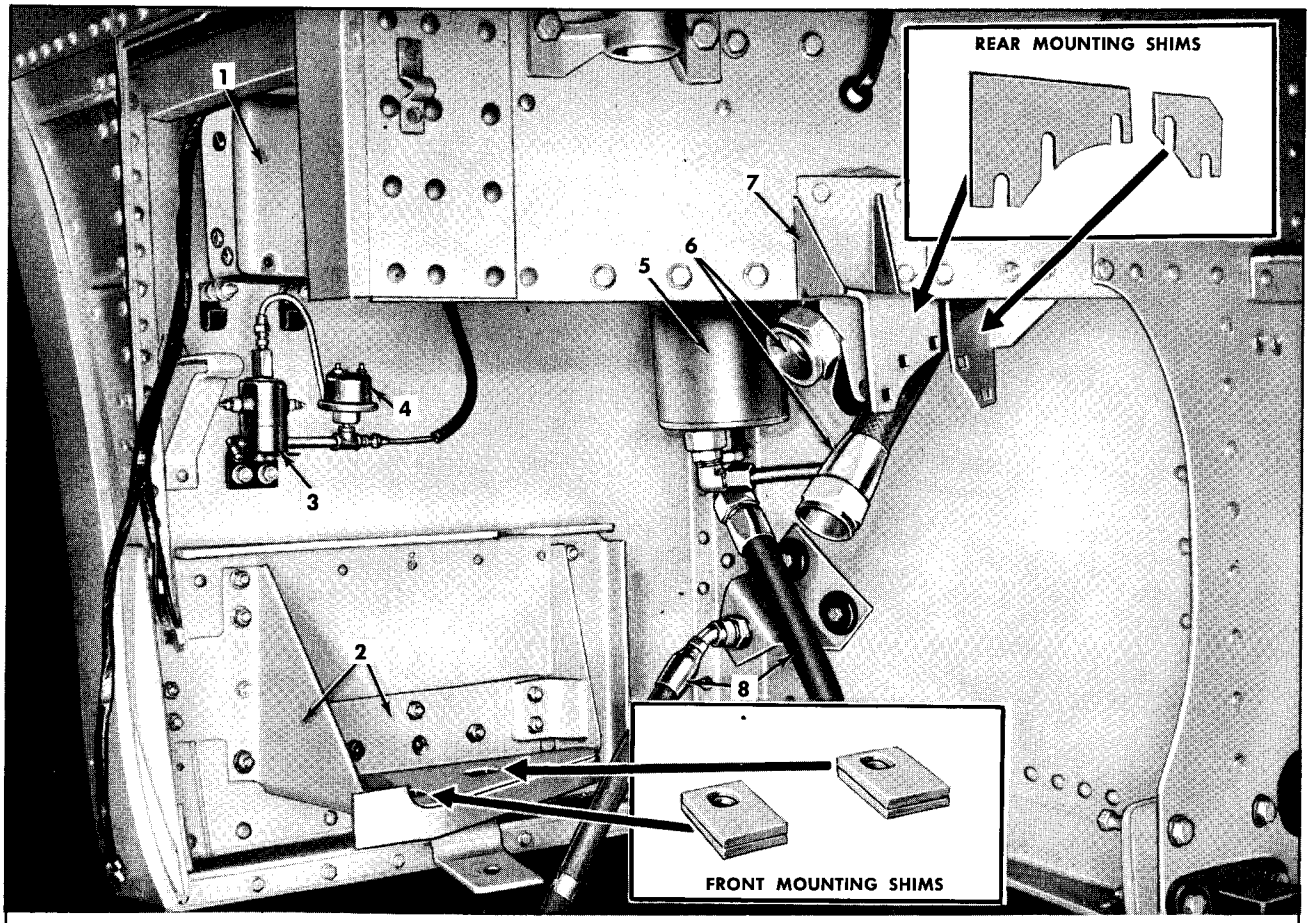
2. At compressor rear mounting bracket (7, fig. 8), remove the bolts attaching compressor to compressor rear mounting bracket inner ring.

NOTE: When compressor is moved forward as it is lifted out of compartment, the drive shaft splines will disengage from splined flange on coupling.

3. Carefully remove the compressor and clutch assembly from compartment. Support the compressor in a manner which will not place weight of compressor assembly on clutch release fork lever.

4. Remove self-locking nuts from coupling bolts at engine accessory drive flange and at compressor drive flange, then remove coupling.

NOTE: The foregoing step (No. 4) is necessary since the alignment tool (fig. 9) MUST be used to insure correct alignment whenever the A/C compressor is being installed.



1 Hi-Lo Pressure Switch
2 Compressor Front Mounting Bracket
3 Compressor Clutch Solenoid Air Valve
4 Air Pressure Switch
5 Condenser Fan Drive Fluid Reservoir
6 Refrigerant Lines
7 Compressor Rear Mounting Bracket
8 Fan Drive Fluid Lines T-1456

Figure 8—Refrigerant Compressor Compartment Showing Mounting Brackets, Shims, and Related Items

REFRIGERANT COMPRESSOR INSTALLATION AND ALIGNMENT

IMPORTANT: Inspect all compressor mountings and brackets before installing compressor and clutch assembly. If any of mountings are not in good condition or if brackets show signs of failure, obtain new parts for replacement as necessary.

The aligning tool shown in Maintenance Manual X-6114, page 35 in SECTION 26 cannot be used for aligning compressors with Morflex coupling. Figure 9 shows tool which must be used. Refer to "Aligning A/C Compressor with Drive" later in this section for instructions for use of aligning tool.

Placing Compressor and Clutch Assembly in Compartment

1. Using same equipment as for removing compressor, lift the compressor and clutch assembly into the compartment. If the rear mounting has not been removed, enter the clutch shaft through opening in center of mounting ring.

2. Place same shims at original locations as were removed when removing compressor, and loosely install the two front mounting bracket-to-bulkhead bracket bolts.

3. If rear mounting bracket and rings have been removed, apply caulking compound (33056-R) over area where bracket overlaps bulkhead and bolt the bracket in place. Tighten bracket bolts to 20 to 25 foot-pounds.

4. Attach compressor rear mounting assembly to clutch housing with four bolts and lock washers, then install rear mounting shims (fig. 8) and mounting-to-bracket bolts. Do not tighten bolts until compressor is aligned by using tool (fig. 9).

Aligning A/C Compressor with Drive Flange

The following procedure is necessary whenever any of the compressor mounting parts are replaced, whenever the compressor is being installed, and whenever the coach power plant assembly is being installed. Use special tool J-9777-4

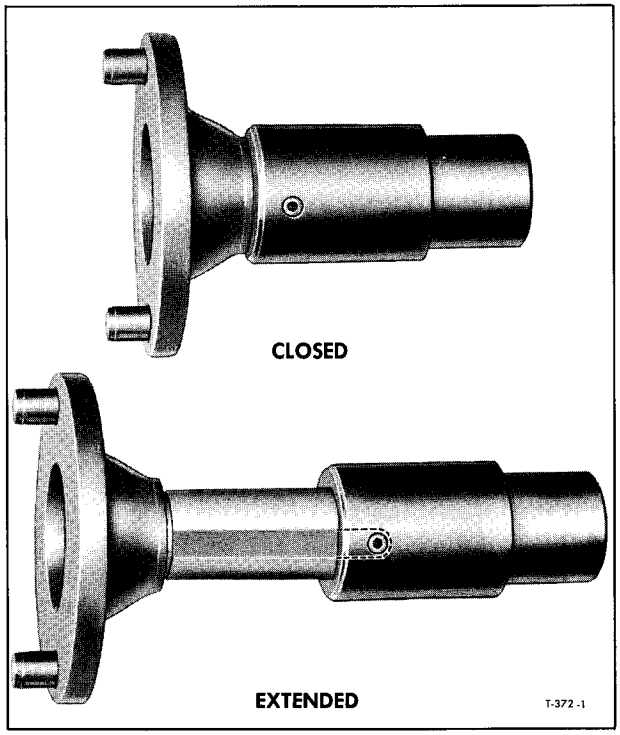


Figure 9—Compressor-To-Engine Alignment Tool

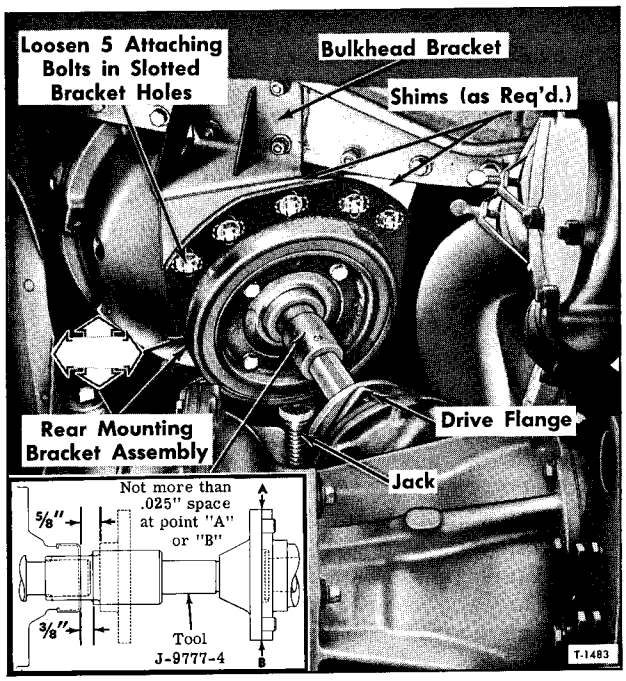


Figure 10—Compressor Alignment Tool Application

(fig. 9) to accomplish alignment.

1. Partially extend alignment tool to expose milled area on tool shaft, then adjust set screw to just contact milled area.

2. Insert tool sleeve over clutch shaft splines and through dust cap on clutch housing, then while holding tool sleeve, pull out flanged end and start pins into bolt holes in accessory drive flange (fig. 10). Shift the compressor assembly as necessary to permit full engagement of pins in flange bolt holes; then fully extend the aligning tool and tighten set screw to lock tool in extended position.

3. Add or remove shims (fig. 8) at compressor front mounting bracket to raise or lower front of compressor assembly. With bolts loosened at front and rear mounting brackets, the compressor assembly can be moved sidewise to align the clutch shaft with drive flange. Shims at rear bracket are used to locate compressor longitudinally.

4. Select shims at rear mounting bracket as required to locate dust cap 3/8-inch from shoulder on tool sleeve. This dimension is important to assure proper spline engagement when coupling is installed and to provide enough space to permit coupling installation after compressor is properly aligned and bolts are tightened.

5. Correct alignment with accessory drive flange is achieved when tool flange fits flush against drive flange with tool pins engaged in flange bolt holes.

NOTE: Angular misalignment must not exceed 0.025-inch when measured with feeler gauge between drive flange and tool flange at two tool pins. Check for misalignment both with tool pins in vertical position as shown in figure 10 and in horizontal position. Engine must be cranked with starter to position the accessory drive flange.

6. To hold rear end of compressor while checking alignment, place jack under rear mounting bracket assembly as shown in figure 10.

7. When compressor is in proper position,

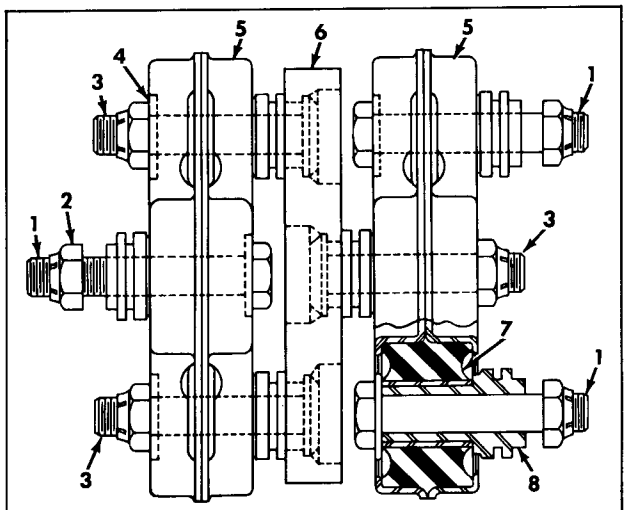


Figure 11—A/C Compressor Coupling Assembly

tighten the five rear mounting bracket to bulkhead bracket bolts to 20 to 25 foot-pounds, and tighten front mounting bracket bolts to 37 to 43 foot-pounds.

8. Loosen set screw in tool, slide tool sleeve off clutch shaft splines, and remove aligning tool.

9. Lubricate splines on clutch shaft, then install splined flange on clutch shaft.

10. Install A/C compressor drive coupling assembly and tighten self-locking bolt nuts to 25 to 30 foot-pounds.

IMPORTANT—A/C COMPRESSOR ALIGNMENT

The air conditioning compressor alignment must be checked as directed above whenever any of the following conditions occur:

1. The vehicle is involved in a rear end collision.
2. The engine is removed.
3. The air conditioning unit is removed.
4. The hydraulic pump drive belts are replaced.
5. The engine stabilizer bars are removed or disturbed.
6. The engine support mounting insulators are replaced.
7. Any other incidents which may disturb the engine mountings and supports, or the air conditioning compressor in any way.

Completing Installation of Compressor Assembly

Accomplish the installation operations given in steps 14. through 25. under "Compressor Installation" in Maintenance Manual X-6114 (SEC. 26), page 34 to complete the A/C compressor installation and prepare the air conditioning system for operation.

COMPRESSOR DRIVE COUPLING

In place of the compressor drive propeller shaft assembly, used on early coaches, a Morflex coupling (fig. 11) is now used. The coupling discs and plate may be disassembled by removing the self-locking stud nuts.

A/C COMPRESSOR DRIVE COUPLING REPLACEMENT

Place coach rear wheels on run-up blocks and remove stone shield from below compressor and clutch assembly. Radiator may be swung outward to provide access to coupling.

Coupling Removal

1. Remove the self-locking nuts from bolts which attach coupling to splined flange at compressor clutch housing and the bolts which attach coupling to accessory drive flange.

2. Push the splined flange onto clutch shaft splines as far as possible, then remove the coupling assembly.

Disassembly

Key numbers refer to figure 11.

1. Remove the four nuts and washers (2 and 4) from the studs which are welded to plate (6).

2. Separate the two disc assemblies (5) from plate (6), then remove two bolts and washers (1 and 4) from each disc assembly (5).

Assembling Drive Coupling (Fig. 11)

1. Place one washer (4) on each of the four bolts (1), then insert two bolts (1) through each of the coupling discs (5) with washers at bolt heads in position shown.

2. With heads of bolts (1) toward plate (6) as shown, install the two disc assemblies (5) on studs in plates (6).

3. Install washer and nut on each plate stud (3). Tighten stud nuts firmly.

Installing Coupling Assembly

NOTE: If any of the conditions described on this page have occurred so that there is reason to suspect that the A/C compressor may not be properly aligned with the accessory drive flange, use special tool J-9777-4 and perform the compressor alignment procedure given previously under "Aligning A/C Compressor with Drive Flange," before installing drive coupling.

1. Install splined flange on compressor clutch shaft.

2. Place drive coupling in position at accessory drive flange with bolts (1, fig. 11) through holes in flange.

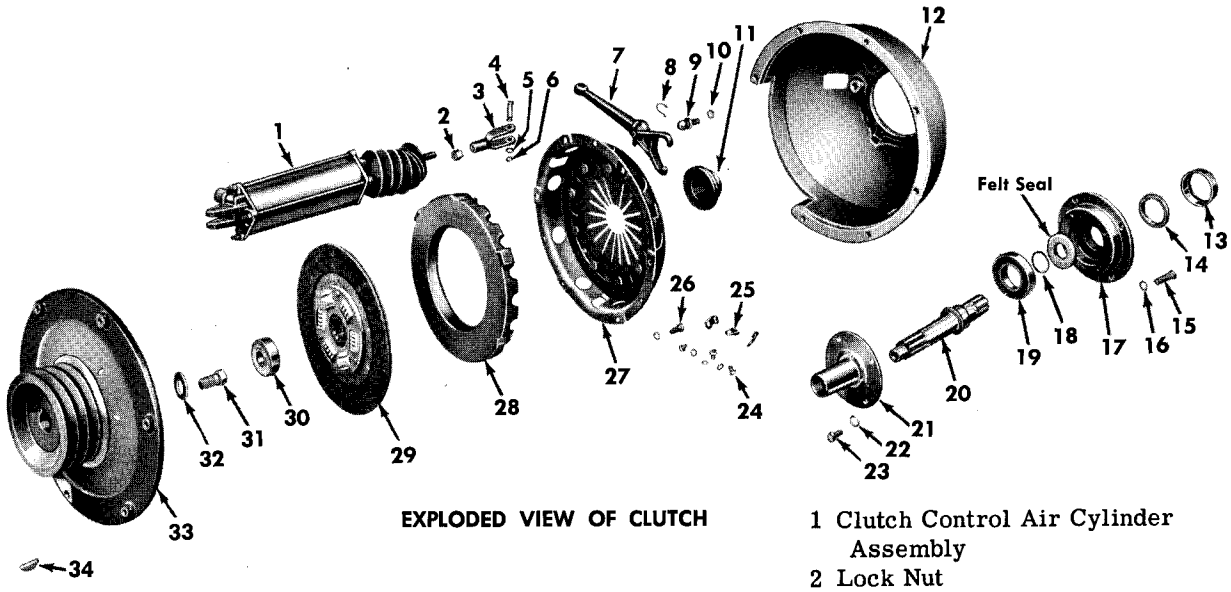
3. Turn splined flange as necessary to align bolt holes in flange with coupling bolts, then pull flange toward coupling. While using wrench at bolt heads, install nuts on bolts at both flanges. Tighten nuts firmly on the four bolts.

REFRIGERANT COMPRESSOR DRIVE CLUTCH

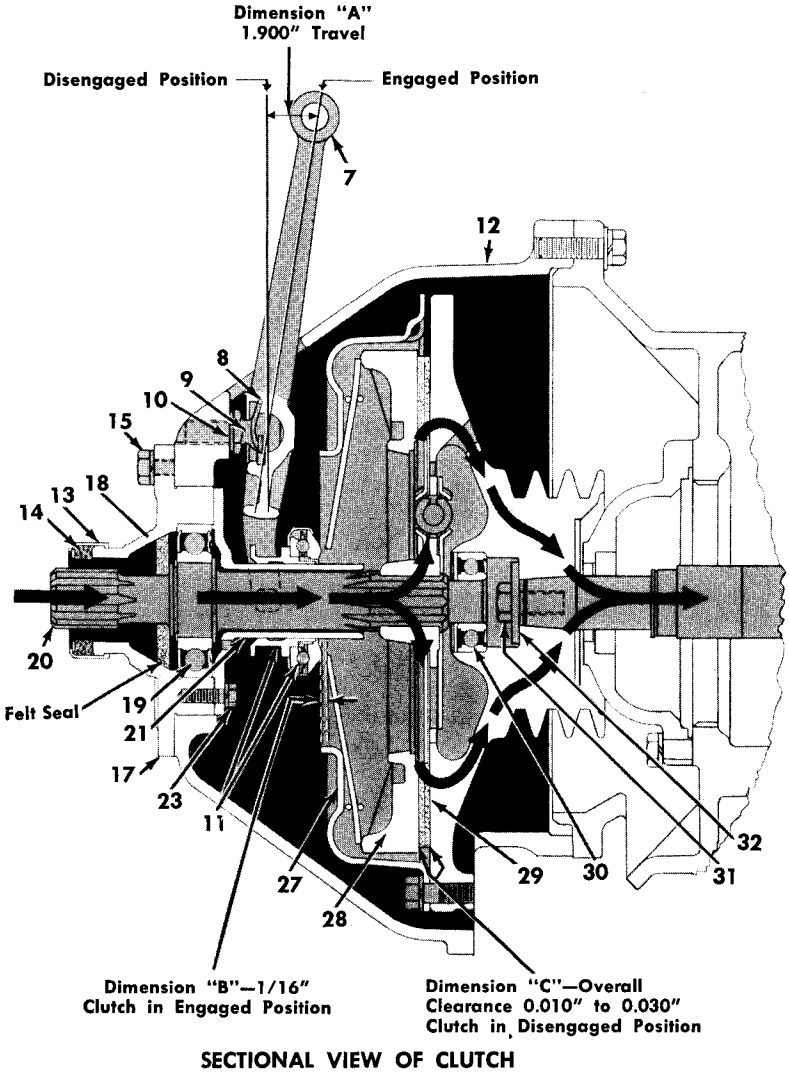
GENERAL

The air conditioning compressor clutch is basically the same on all coaches, however, on late production coaches, changes have been made at clutch flywheel, clutch shaft, pilot bearing and clutch shaft main bearing carrier which affect clutch overhaul and lubricating procedures.

Refer to figure 12 for cross section view and disassembled view of compressor clutch of latest design.



EXPLODED VIEW OF CLUTCH



SECTIONAL VIEW OF CLUTCH

1 Clutch Control Air Cylinder Assembly
2 Lock Nut
3 Push Rod Yoke
4 Yoke Pin
5 Yoke Pin Retainer Washer
6 Yoke Pin O-ring
7 Clutch Release Fork
8 Retainer Spring
9 Ball Stud
10 External Lock Washer
11 Clutch Release Bearing Assy.
12 Clutch Housing
13 Cork Seal Retainer Cap
14 Cork Seal
15 Carrier Attaching Bolt
16 Lock Washer
17 Main Bearing Carrier
18 Bearing Retainer Ring
19 Main Bearing Assembly
20 Clutch Shaft
21 Main Bearing Retainer
22 Lock Washer
23 Retainer Attaching Bolts
24 Spring Attaching Screws and Washers
25 Pressure Plate Retracting Springs
26 Cover-to-Flywheel Attaching Bolts and Washers
27 Pressure Plate Cover Assembly
28 Pressure Plate
29 Drive Plate Assembly
30 Clutch Shaft Pilot Bearing Assy.
31 Flywheel-to-Compressor Shaft Bolt
32 Flat Washer
33 Compressor Flywheel
34 Flywheel-to-Compressor Drive Key

T-1492

Figure 12—Air Conditioning Drive Clutch Components

AIR CONDITIONING

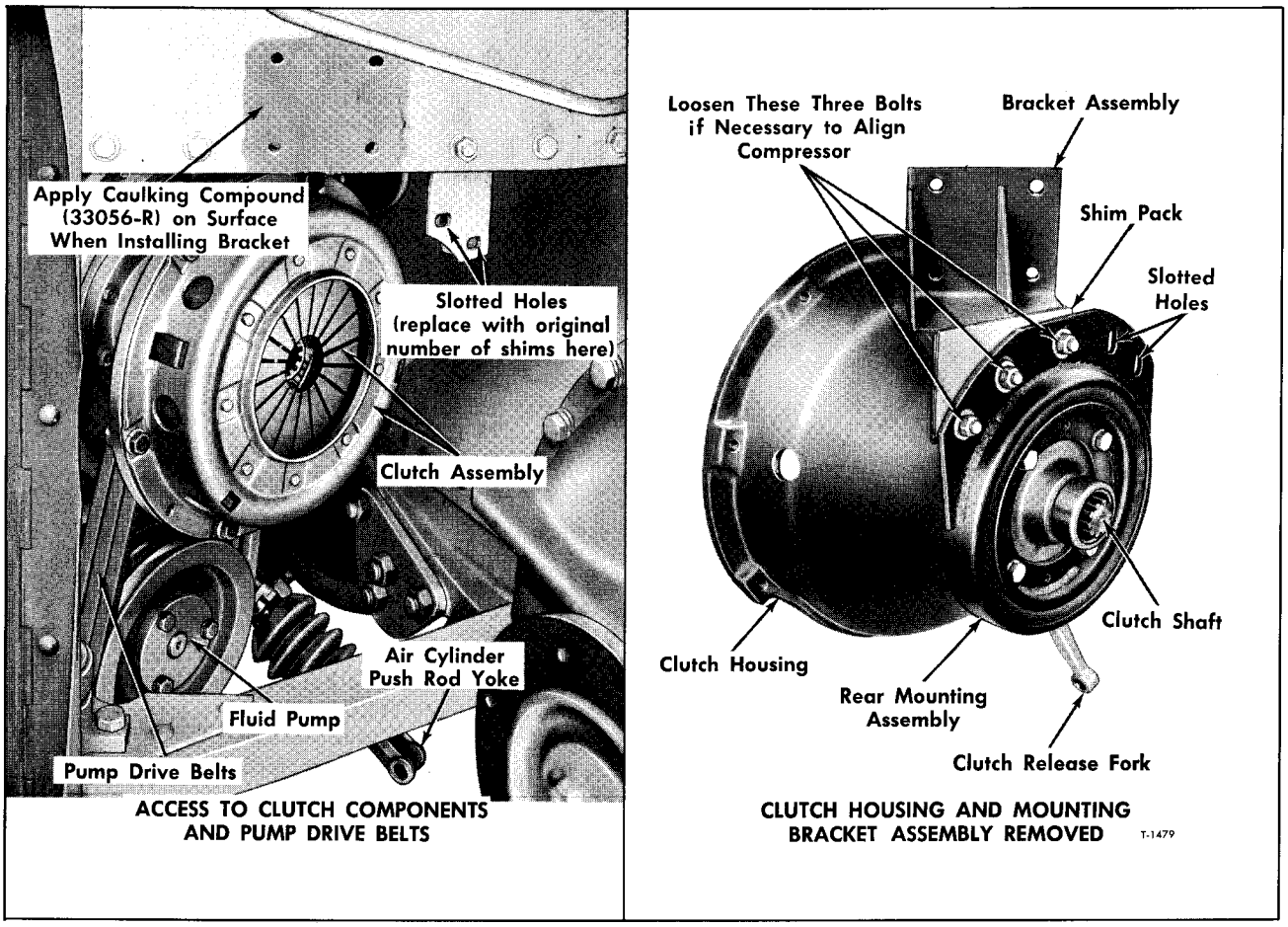


Figure 13—Clutch Housing Assembly Removed from Compressor

CLUTCH REMOVAL AND DISASSEMBLY

The air conditioning clutch removal procedure as given in AIR CONDITIONING (SEC. 26) beginning on page 47 in Maintenance Manual X-6114 can be used to remove the clutch assembly from all coaches, except that steps 9 and 10, page 49, may be omitted, since it is recommended the tool (figs. 9 and 10) always be used to align the compressor with accessory drive when installing clutch.

Figure 12 shows A/C clutch components. Notice that a felt seal has been added in main bearing carrier and the lubrication fitting is no longer used in the main bearing carrier. Lubricant is applied in carrier cavity at assembly. Also, lubricant passages have been added to clutch shaft and a fitting installed in coupling flange for use in lubricating shaft splines and pilot bearing (fig. 14).

Figure 13 shows the latest compressor rear bracket and mounting ring.

INSPECTION AND REPAIR OF CLUTCH COMPONENTS

Same inspection and repair procedure as given in X-6114 are applicable to late production coaches, and in addition, the lubrication passages (fig. 14) in clutch shaft should be cleaned to make sure there are no obstructions. Also be sure the 1/16-inch diameter vent hole in clutch flywheel is not obstructed.

A/C COMPRESSOR CLUTCH ASSEMBLY AND INSTALLATION

The assembly procedures given for assembling and installing A/C clutch are applicable to late coaches with exceptions indicated in following paragraphs.

Compressor Flywheel Installation

Before installing compressor flywheel on compressor crankshaft, wipe the tapered surface which mates with flywheel with clean engine oil.

Clutch Cover Installation

The clutch drive plate assembly (29, fig. 12) now carries a decal reading "PRESSURE PLATE SIDE." Be sure to install plate in accordance with decal.